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**PHASE I REMOTE SENSING ARCHEOLOGICAL SURVEY
FOR THE MEDORA CROSSING SOFT DIKE CONSTRUCTION PROJECT
MISSISSIPPI RIVER, LOUISIANA**

May 1999

Final Report

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Prepared for

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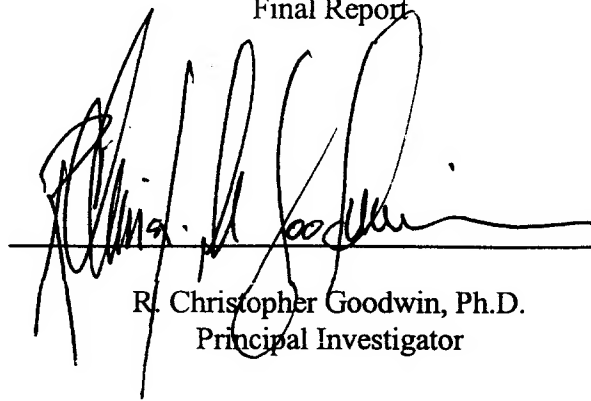
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MISSISSIPPI RIVER, LOUISIANA

Final Report



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ABSTRACT

This report presents the results of a Phase I marine remote sensing survey for the Medora Crossing Soft Dike Construction Project on the Mississippi River, Iberville Parish, Louisiana. These investigations were conducted during November 1998, by R. Christopher Goodwin & Associates, Inc. on behalf of the U.S. Army Corps of Engineers, New Orleans District (USACE-NOD). The study was undertaken to assist the USACE-NOD in satisfying its responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended. All aspects of the investigations were completed in accordance with the Scope-of-Work, and the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (Federal Register 48, No 190, 1983).

The planned soft dike construction in the project area will require the placement of three dikes along a portion of the river's left descending bank. The survey area measures approximately 1,800 ft (548.65 m) x 7016 ft (2138.50 m) and is located predominately outside of the main shipping channel. The objectives of this study were to identify specific targets within the project area that might represent significant submerged cultural resources, and to provide the USACE-NOD with management recommendations for such resources. These objectives were met with a research design that combined background archival investigations and a marine archeological remote sensing survey.

Background research and archival investigations indicated a moderate potential for encountering submerged historic cultural resources within the project area. A review of Louisiana archeological site files and relevant research reports documented only three terrestrial archeological sites within a one mile (1.6 km) radius of the project area, however, none were reported within the boundaries of the project area. A 1989 study conducted for the Army Corps of Engineers by Coastal Environments, Inc. reports the loss of 17 vessels in the vicinity of the project. However, these are listed as sinking outside of the study area at Plaquemine Bend. The National Oceanic and Atmospheric Administration's (NOAA) Automated Wreck and Obstruction Information System (AWOIS) and several secondary sources reports no losses in the project area.

Archeological investigations consisted of a controlled marine remote sensing survey of approximately 46.5 linear miles (74.8 km) of river bottom. This survey utilized a differential global positioning system (DGPS), a digital recording side scan sonar, a recording proton precession magnetometer, and hydrographic navigational computer software. The survey was conducted at a lane spacing of 50 ft (15.24 m) to ensure the greatest detail in coverage. If any historic vessels had been abandoned or destroyed in the survey area, they would have been readily detectable with the remote sensing instruments employed during the survey. The marine remote sensing survey registered a total of 117 individual magnetic anomalies. A total of 24 acoustic anomalies also were recorded, none of which had correlating magnetic anomalies.

Archival records and analysis of the archeological data collected during the study yielded no evidence suggesting the presence of potentially significant cultural resources within the project area. Therefore, no additional investigations are warranted or recommended for the proposed Medora Crossing Soft Dike Construction Project area.

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CHAPTER I

INTRODUCTION

Project Location and Description

This report documents the results of a Phase I marine remote sensing survey for the Medora Crossing Soft Dike Construction Project, located on the Mississippi River in Iberville Parish, Louisiana (Figure 1). The project area extends from approximately M-211 to M-213 adjacent to the river's left descending bank. The marine remote sensing survey was conducted in one continuous survey block within a boundary formed by the following geographic points (Figure 2):

Corner #	X	Y
1	3328183.7783	661228.1223
2	3320889.7884	659639.2017
3	3328078.03	659502.956
4	3321983.1641	658281.9678

This study was undertaken by R. Christopher Goodwin & Associates, Inc. on behalf of the U.S. Army Engineers, New Orleans District, in support of the proposed construction of a series of soft dike structures on the riverbed outside of the main navigation channel. The dikes are intended to concentrate the flow of the river current within the channel, in order to maintain a minimum channel depth. Three dikes perpendicular to the left descending bank (Figure 3), ranging in length from approximately 800 ft to 1700 ft (243.84 m to 518.17 m), are proposed for construction. During the marine remote sensing survey, approximately 46.5 linear miles of river bottom were surveyed. It should be noted that the survey block delineated above encompasses the actual impact areas for the soft dike construction project. Those impact areas include the soft dike structures and a proposed borrow area. The total area of impact represents only 5-10 per cent of the overall survey block. Consequently, some submerged anomalies identified during this study will not be impacted by the proposed project.

The stretch of the Mississippi River comprising the project area is subject to heavy vessel traffic due in part to its proximity to the Port of Baton Rouge and the presence of oil and chemical depots. Vessel traffic consists primarily of pushboats with large, numerous barge configurations, tankers, and occasional passenger vessels (Figures 4 and 5 [Top]).

Research Objectives and Designs

In keeping with the New Orleans District's mission to preserve, document, and protect significant cultural resources, magnetic and acoustic remote sensing surveys were undertaken to locate potential archeological remains. All archeological investigations were accomplished in full compliance with the National Historic Preservation Act (NHPA) of 1966, as amended; with 36 CFR 800, "Protection of Historic Properties;" with the Abandoned Shipwreck Act of 1987 (43

U.S.C. 2101-2106); with Abandoned Shipwreck Guidelines, National Park Service; with National Register Bulletins Nos. 14, 16, and 20; and with 36 CFR 66.

The objectives of this study were to identify all submerged and visible water craft and other maritime related cultural resources in the Medora Crossing project area, and to assess the National Register of Historic Places (NRHP) eligibility of identified resources. These objectives were addressed through a combination of archival research and field survey. The background study and history of the project area were researched through examination of archeological site files for the State of Louisiana, local historical literature files, previous cultural resources investigations within the vicinity of the project area, historic maps, and relevant secondary literature.

Planning and background research for the survey began in September of 1998. Fieldwork was conducted between November 1-9, 1998. Dr. R. Christopher Goodwin served as Principal Investigator for the project; Nautical Archeologists, Dr. John Seidel and Jean B. Pelletier, M.A., acted as Co-Project Managers, and directed all aspects of data collection and its subsequent analysis. Mr. Pelletier was assisted by Remote Sensing Specialists, Mr. William B. Barr, M.A.; Mr. David W. Trubey, B.A.; and survey vessel operator, Captain Samuel LeBouef.

Organization of the Report

This report places the project area within its natural and historical contexts and seeks to examine the findings of the field investigations within those contexts. The natural setting of the project area is discussed in Chapter II. Chapter III places the project area within its prehistoric context. Chapter IV places the project area within its historical context. The maritime history of the project area is presented in Chapter V. Details concerning the instrumentation and methods employed during survey are described in Chapter VI. Chapter VI examines the archeological potential of the project area while the results of the survey and recommendations to avoid impact to selected anomalies are presented in Chapter VIII. Appendix I contains the project Scope of Work and Appendix II presents resumes of key project personnel.

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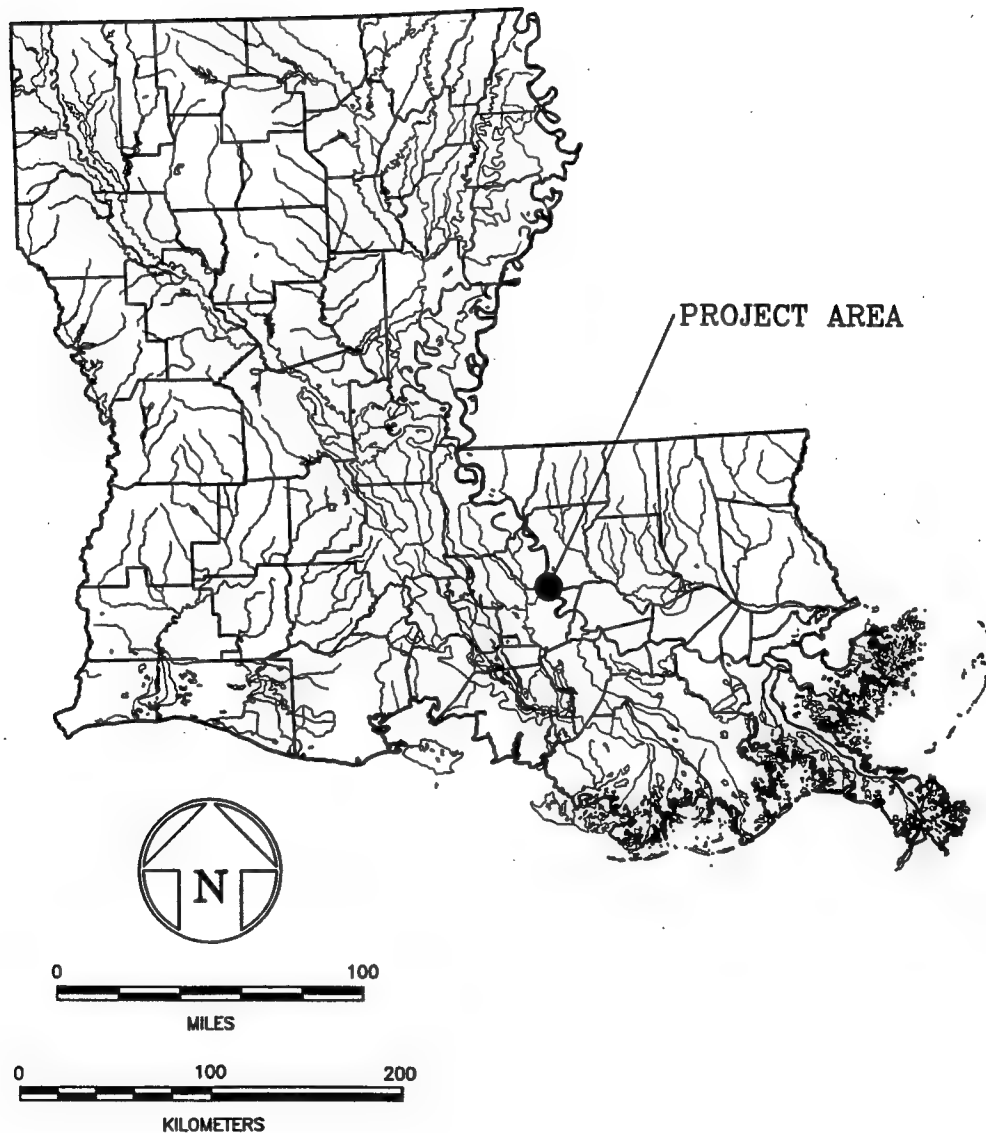


Figure 1. Map of Louisiana showing location of project

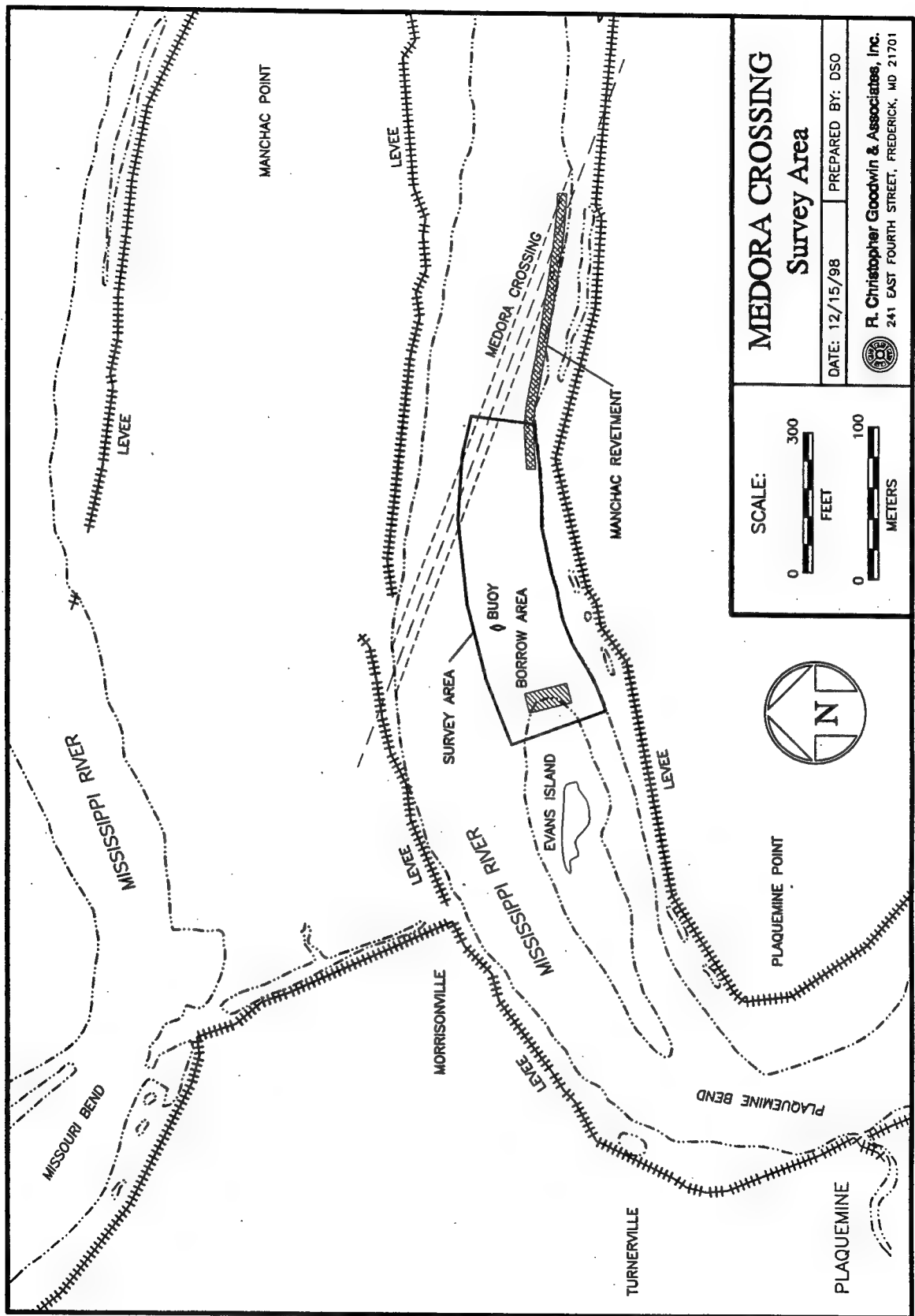


Figure 2. Medora Crossing Soft Dike Construction Project Survey Area, Mississippi River, Iberville Parish, Louisiana

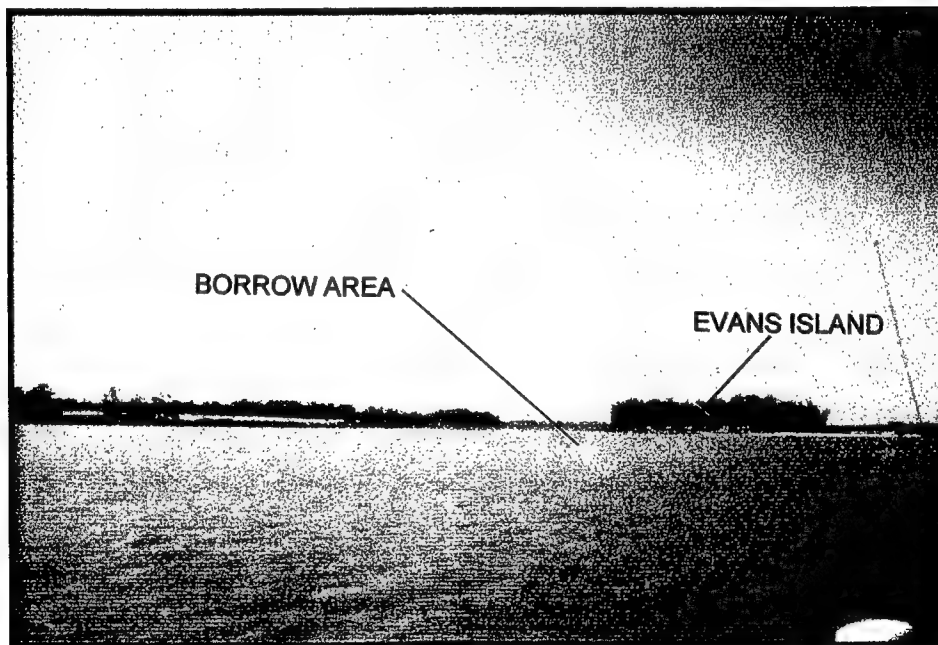
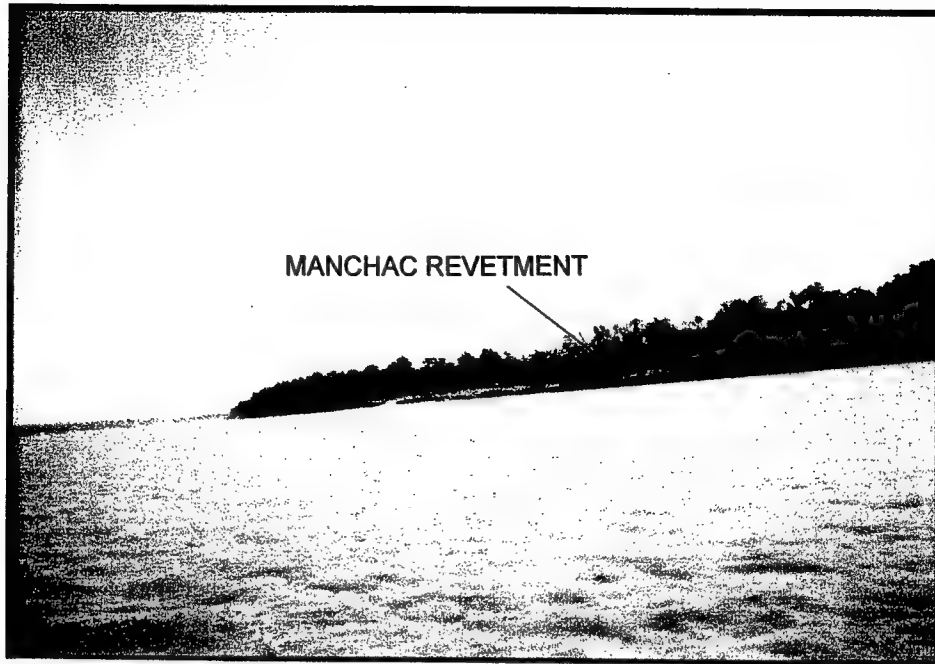


Figure 3. Medora Crossing Soft Dike Construction Project Area: (Top) Photograph of left descending river bank. (Bottom) Photograph of left descending riverbank looking towards Borrow Area and Evans Island

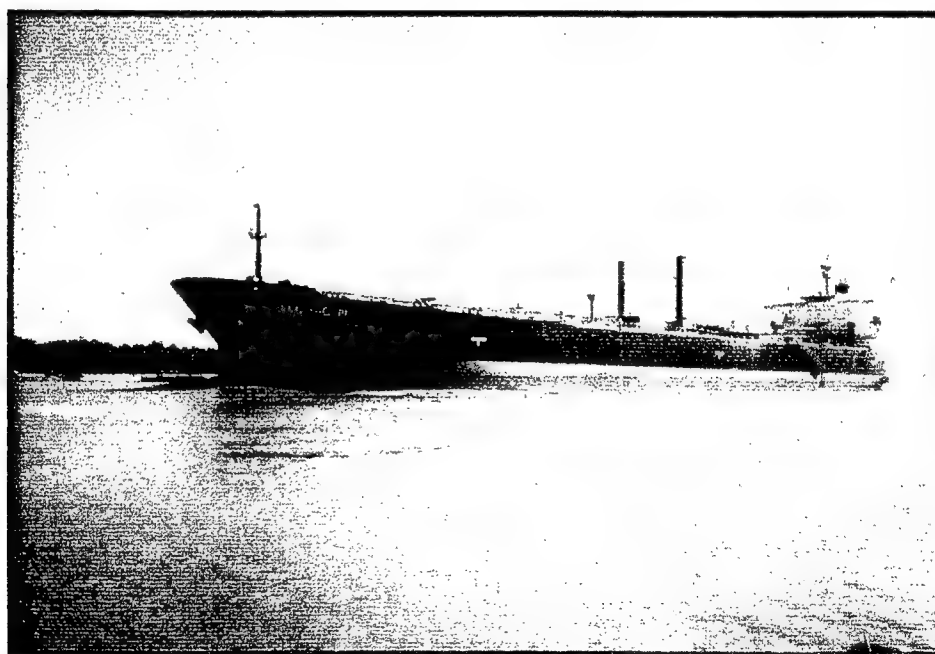
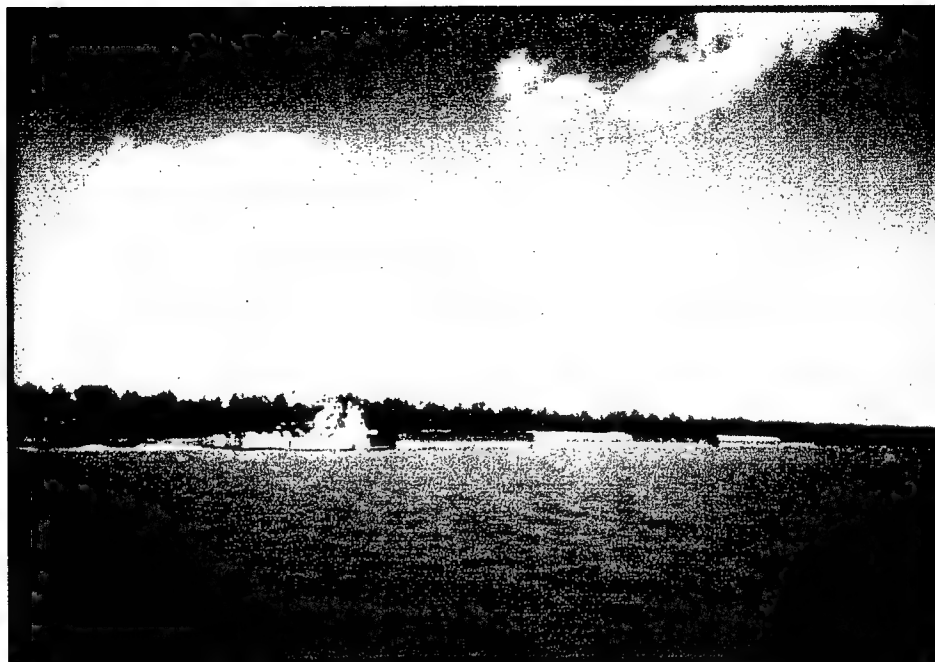


Figure 4. Medora Crossing Soft Dike Construction Project Area: (Top) Photograph of pushboat and barge traffic in river channel. (Bottom) Photograph of tanker traffic in river channel

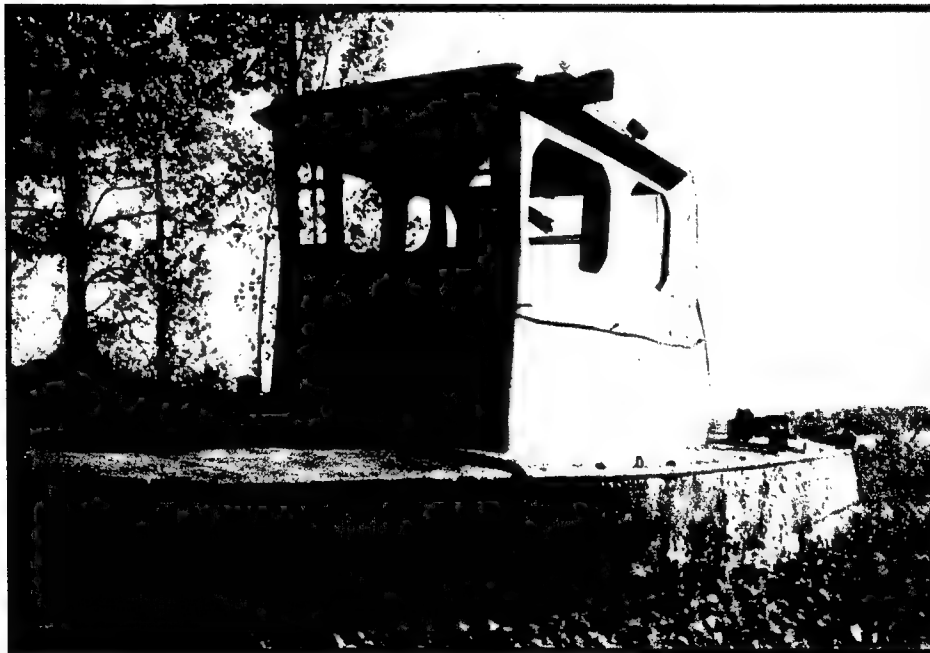
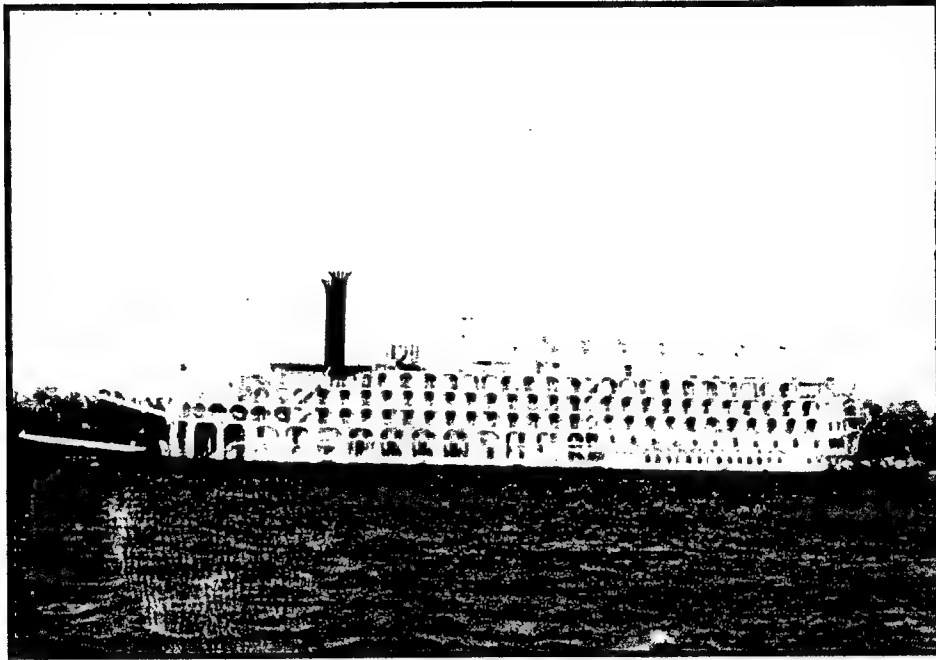


Figure 5. Medora Crossing Soft Dike Construction Project Area: (Top) Photograph of passenger vessel *American Queen* near survey area on way to Port of New Orleans. (Bottom) Photograph of displaced pushboat *Joseph* high on shore approximately 60 yards from river

CHAPTER II

NATURAL SETTING

This chapter contains a brief overview of the geologic framework, a description of the geomorphic setting and processes, and a reconstruction of the geomorphology and chronology of the project area. It serves to provide a geosciences framework for a cultural resources survey of possible prehistoric archaeological sites, and an evaluation of channel and bankline changes as they may have affected historic-period resources.

The project corridor lies in a dynamic deltaic plain setting in which physical changes in the landscape have been relatively rapid and appreciable during the time frame of human occupancy. Consequently, to a large extent the landscape has been a deterministic factor in where and how humans settled and subsisted. Further, it has been a major factor in determining where historic resources may be located and their state of preservation.

The technical literature contains a wealth of summarized and synthesized information on the general geology and geomorphology of the project area (e.g., Fisk 1944; Kolb and VanLopik 1958; Autin et al. 1991; Saucier 1963, 1994) as well as the results of detailed geologic mapping (Saucier 1969). In addition, soils surveys provide information on the character and distribution of surficial deposits and their influence on vegetation (Powell et al. 1982; Spicer et al. 1977). Specific geomorphic evaluations of the project area were made using a 1:24,000-scale topographic quadrangle (Plaquemine, LA) and 1:20,000-scale photo mosaics contained in the soils surveys. Observations from these were combined with the writer's appreciable familiarity with the geomorphology and geoarcheology of the project vicinity as the base for the interpretations presented herein. Information concerning historic period channel changes was derived from the topographic quadrangle as well as various historic surveys. Data on known cultural resources in the vicinity were obtained from state site files (Louisiana Division of Archaeology) and provided by R. Christopher Goodwin & Associates, Inc. The scope and nature of the project did not warrant a specific field inspection of the project area, although the writer has visited it in the past (Saucier 1969).

Project Location

The project area involves the present channel and adjacent banks of the Mississippi River in south-central Louisiana, about 22.4 km (14 mi) south of the city of Baton Rouge. It is situated in eastern Iberville Parish about 4 km (2.5 mi) upstream along the Mississippi River from the town of Plaquemine (Figure 2), or between river miles 210.8 and 211.9 above Head of Passes (AHP). In terms of hydrography, the project area is located immediately downstream from what is referred to as Medora Crossing. This is where the deepest part of the river channel (the thalweg) switches from close to the southern (left descending) bank to close to the northern (right descending) bank.

The scope of the project calls for an underwater remote sensing survey of the channel bottom and banks of the crossing area, involving approximately 1.99 sq km (0.77 sq mi).

Regional Physiography and Geologic Setting

The project lies within the Mississippi Valley subsection of the Gulf segment of the Gulf and Atlantic Coastal Plain province of North America (Murray 1961). In terms of the nature of the geomorphic processes and depositional environments (Autin et al. 1991), it lies at the extreme lower end of the alluvial valley of the lower Mississippi River just upstream from the valley's transition into the deltaic plain. It is included within the Atchafalaya Basin segment of the alluvial valley very close to its eastern margin (Saucier 1994). However, from a different perspective, if the deltaic plain is defined as including all lands (and water) south of the northernmost major Mississippi River distributary (which is the Atchafalaya River), the project technically would lie in the Mississippi River delta (Russell 1940).

Irrespective of this different view point, the lower end of the alluvial valley and/or the upper end of the deltaic plain is an exceptionally flat and low-lying tract of alluvial land that is overwhelmingly dominated by two landscapes, i.e., broad expanses of wetlands in shallow basins characterized by swamps, marshes, shallow lakes, and sluggish streams; and low, narrow natural levee ridges (meander belts) flanking the present course of the Mississippi River and its numerous abandoned distributaries.

At the project latitude, the Atchafalaya Basin is a 95-km-wide (58.9-mi-wide) lowland bounded by a low terrace (Prairie complex) of late Pleistocene age (Saucier and Snead 1989). The present meander belt of the Mississippi River (Hm₁, Figure 6) trends southeastward near the eastern margin of the basin. The vast majority of the wetlands of the basin lie to the west of the meander belt, but a small yet significant wetland area lies between the meander belt and the eastern basin limit (called the Spanish Lake Lowland). Hence, the river at the project locale lies in the midst of an alluvial ridge which is bordered by broad, fresh-water, swampy tracts.

The Mississippi alluvial valley and deltaic plain areas have been affected for millions of years by downwarping within the broad, north-south trending Mississippi Embayment and the east-west trending Gulf Coast Syncline (Saucier 1994). This has resulted in the deposition during the Tertiary and Quaternary periods of tens of thousands of feet of sediments in alternating fluvial, deltaic, estuarine, and shallow marine environments. Accompanying the downwarping and sedimentation have been the formation of zones of east-west trending growth faults and the intrusion of diapiric salt structures (Murray 1961), although none of these are particularly important in the project area.

Within this structural framework, events relevant to this report are those that occurred during the Pleistocene and Holocene epochs. Constituting the last 2.5 million years of geologic time, these epochs were dominated by multiple cycles of continental glacier advance and retreat and accompanying major sea level rise and fall. Glaciers did not directly affect the Lower Mississippi Valley area, but on several occasions the alluvial valley served as a giant sluiceway for the transport of vast volumes of meltwater and glacial outwash to the Gulf of Mexico. Glacial stages were episodes marked by a Mississippi River braided stream regime, the transport and deposition largely of sands and gravels, and relatively low sea level stands (Autin et al. 1991). In contrast, interglacial stages were times of stream meandering and meander belt formation, predominantly fine-grained sediment loads (silts and clays), and relatively high sea level stands. Near the Gulf Coast, glacial stages were times of valley deepening and widening and Gulf



Figure 6. Geologic map of the Atchafalaya Basin area

shorelines well south of their present location. Interglacial stages were times of valley filling, transgressing shorelines, and eventually deltaic plain formation.

The Mississippi alluvial valley in the Atchafalaya Basin area is the cumulative product of multiple episodes of entrenchment and planation during the Pleistocene. However, most of this valley degradation occurred during the Late Wisconsinan stage of the Pleistocene (advance and retreat of the Laurentide ice sheet) when Tertiary and early Pleistocene formations beneath the alluvial valley were scoured to depths of as much as 120 m (394 ft). In the project vicinity, the eastern edge (escarpment) of the entrenched valley is marked by the outcrop of the Prairie complex surface (Saucier 1994) which is believed to date to the Sangamon and Mid-Wisconsinan stages. Westward from the escarpment, the surface of the deposits deepens rapidly and has been estimated to be at an elevation between about 61 and 91 m (200 to 300 ft) below sea level (Saucier 1969). More recent contouring of the Pleistocene surface, based on modified concepts of origin and using computer contouring techniques, place it at elevations of about 55 to 61 m (180 to 200 ft) (Saucier 1994).

Alluvial deposits that fill the entrenched valley beneath the floodplain of the Atchafalaya Basin area consist of a coarse-grained substratum (Pleistocene) and a fine-grained topstratum (Holocene) (Saucier 1969, 1994). Substratum deposits consist primarily of sands and gravels (glacial outwash) of Late Wisconsinan-stage age that extend from the base of the entrenchment to an elevation of about -24 to -27 m (-80 to -90 ft). They are the result of intense fluvial activity during a time of rapidly rising sea level.

The fine-grained topstratum, 33 to 36 m (110 to 120 ft) thick, represents overbank deposition by the Mississippi River while flowing in meandering or anastomosing regimes after it ceased carrying a large load of meltwater and outwash. Following a classification scheme long in use in the Lower Mississippi Valley (Kolb and VanLopik 1958), topstratum deposits represent several discrete environments of deposition. Across the broad expanse of the Atchafalaya Basin and in the Spanish Lake Lowland, a majority of the deposits were laid down in a backswamp environment (which sometimes includes a lacustrine environment) (Krinitzsky and Smith 1969). Within the Mississippi River meander belt, the deposits were laid down in either point bar or natural levee environments. Whereas abandoned channels (cutoffs) are characteristic meander belt features in much of the alluvial valley area, none are present in the project vicinity. The farthest downstream cutoff on the river occurs about 61 km (38 mi) north of the project area (Saucier 1994).

As will be discussed later, backswamp deposits started accumulating in the project vicinity about 12,000 years ago whereas the natural levee and point bar deposits date back to only about 4,800 years ago. Placing these time intervals in perspective in terms of sea level history, it is believed by most geologists that sea level was perhaps as much as 30 m (98 ft) lower than at present at 12,000 years ago. What happened after that time is highly argumentative among Gulf Coast geologists (see discussion in Saucier 1994), but a consensus appears to be that sea level rose episodically and reached its approximate present level about 3,000 years ago. This means that a substantial part of the backswamp deposit sequence was laid down under significantly lower sea levels as were the older natural levee and point bar deposits. Since about 3,000 years ago, sea level has not been a major factor; however, regional and local subsidence have continued at a rate of several centimeters per century. Hence, all deposits of the project vicinity have been affected to some degree by subsidence.

Project Area Description

The Medora Crossing area involves the Mississippi River channel in the midst of a series of highly sinuous river bends. The north (right descending) river bank at the crossing lies on Manchac (or Australia) Point, while the south (left descending) river bank lies on Plaquemine Point. At the low water reference plane (elevation 0.52 m [1.7 ft]), the river channel is between about 1,320 and 960 m (4,330 and 3,149 ft) wide. The deepest part of the thalweg, located very close to the north bank, is at an elevation of slightly over 24 m (80 ft) below sea level. Near the south bank, and near the downstream limit of the project area, there is an unnamed island (or towhead), the upstream end of which is emergent at the elevation of the low water reference plane and which extends as a sand bar into the project area. A relatively shallow chute separates the island (and sandbar extension) from Plaquemine Point.

Highest elevations in the project vicinity occur along the crests of the natural levees immediately adjacent to the channel. Here, they attain elevations of between about 7.6 and 9.1 m (25 and 30 ft). As a consequence, at extremely low water, the immediate river banks are about an equal distance high and are moderately to very steep (before artificial bank protection). Along the south bank, the main Mississippi River flood-control levee is close to and parallels the channel, being set back less than 200 m (656 ft) from the river bank. Along the north bank, an older, smaller levee is present, having been abandoned because of the threat of bank caving and consequent levee failure. Thus, land south of the project area on Plaquemine Point is protected from river flooding, whereas land north of the area on Manchac Point is not protected.

With the river thalweg (and hence navigation channel) being close to the north bank, historically this is logically where boat landings have been located. Vessels avoided the south bank where shallower water made navigation difficult at low river stages. Early surveys (Mississippi River Commission 1884) show the project area to include a landing at the Medora Plantation and just downstream from a landing at the Clara Belle Plantation.

During most of the historic period, slow but persistent bank erosion has been the dominant process along the steep north bank (referred to as a cutbank). However, this was arrested in 1989 with the construction of an articulated concrete mattress revetment (with associated upper bank grading) in the project area (Mississippi River Commission 1994). In contrast, the less-steep south bank historically has witnessed slow but persistent point bar accretion. For example, river navigation charts indicate an average bank buildout of between 100 and 200 m (328 to 656 ft) between the 1940s and the 1990s. During the same time, the towhead has migrated downstream on the order of several hundred meters.

Geomorphic Processes and Depositional Environments

The three depositional environments of the project vicinity are shown in plan in Figure 7, which is taken from Saucier (1969). Each is discussed briefly in the following paragraphs in order of their relative importance to the purposes of this project.

Natural levees are low, gently sloping alluvial ridges that flank streams that carry high suspended sediment loads and that periodically overtop their banks. The ridges are highest near the stream channels and slope outward (distally) toward the adjacent floodbasins (backswamps). Along the present Mississippi River meander belt between Baton Rouge and New Orleans, the natural levee on each side of the stream channel averages between 2 and 3 km (1.2 and 1.9 mi) wide and about 3.0 to 4.6 m (10 to 15 ft) high (from levee crest to adjacent backswamp levels).

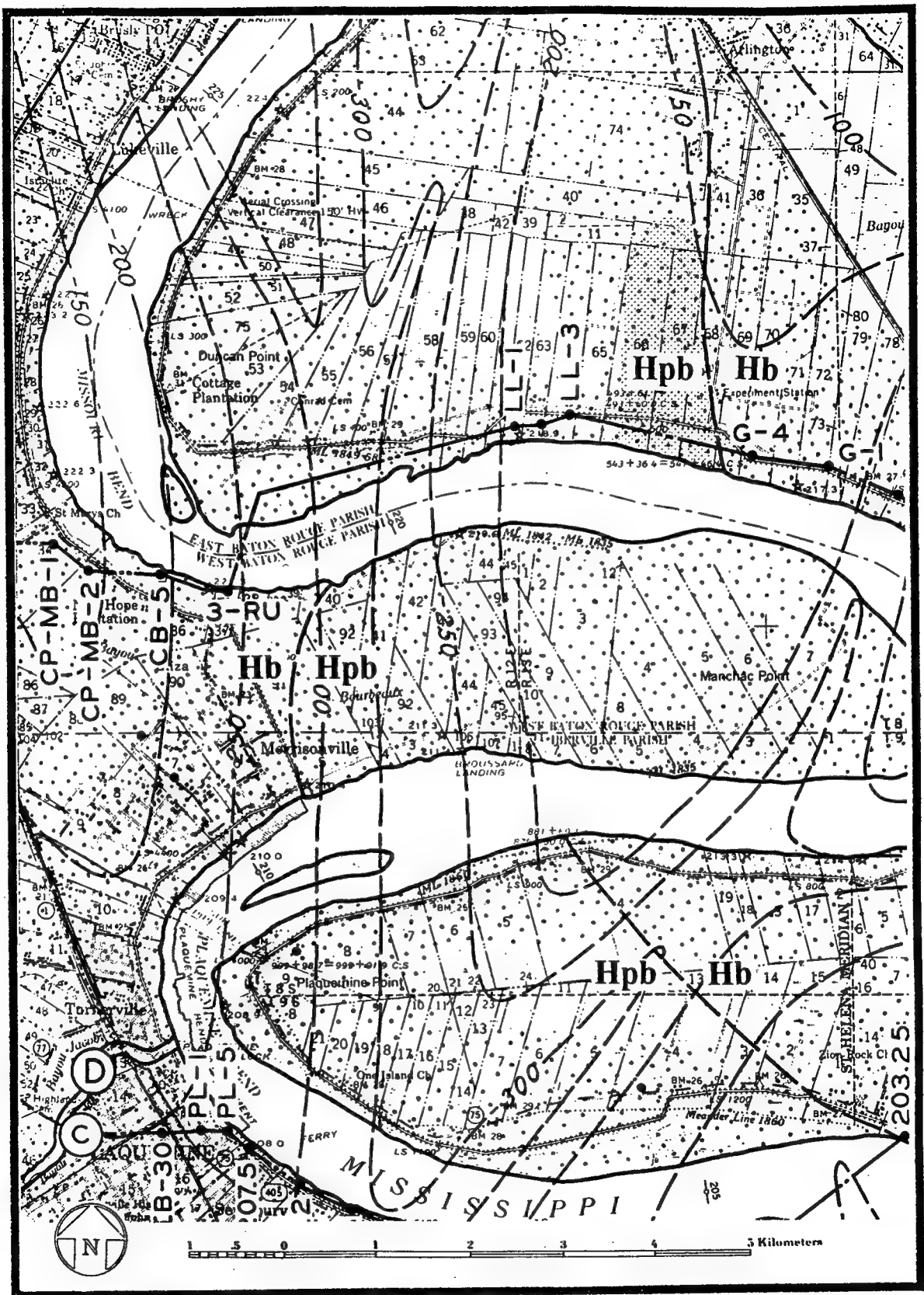


Figure 7. Map of Medora Crossing vicinity showing depositional environments

However, in the project vicinity, because of the sharpness of the river bends and the amount of channel meandering, each levee is only about 1 km (0.6 mi) wide but of comparable height.

Natural levee deposits provide the firmest and relatively most flood-free terrain of the Holocene alluvial valley. They consist of up to 6 m (20 ft) of well-oxidized, very firm to stiff, gray and brown silty clays and clayey silts with occasional zones of silt to fine sand (Kolb 1962). Most natural levee deposits are laid down by sediment-carrying sheet flow that is filtered by heavy vegetation. However, during times of severe floods, overbank flow may become channelized, forming crevasses. Scour pools and incised channels will form across the natural levee crests and will be naturally backfilled with silt and fine sand as the flood recedes. These crevasse channels become weak points in the natural levee and may be the sites of subsequent crevassing since the silt and sand deposits are less erosion resistant than the silty clay deposits.

On Plaquemine Point, where the natural levee is protected from flooding by an artificial levee, the soils have been identified as (from highest areas to lowest) Commerce silty clay loam, Commerce silt loam, Sharkey silty clay loam, and Sharkey clay (Spicer et al. 1977). However, on Manchac Point where the soils are not protected and rather frequently flooded, they are identified as belonging to the Convent series. These same soils are present on the narrow batture area that lies between the river channel and the artificial levee on Plaquemine Point. Since effective flood control has been established along the river, battures have been characterized by increased flooding frequency, coarser-grained deposits (more silts and sands), and extensive borrowing for construction materials. It should be noted that over much of Manchac Point north of the project area, which is in West Baton Rouge Parish, soils of unprotected areas have been mapped as belonging to the Robinsonville-Commerce series, rather than the Convent series (Powell et al. 1982).

Soils of the protected natural levees are almost totally in agriculture, but before clearing, supported a vegetative assemblage consisting of mixed, deciduous, hardwood species such as oaks (*Quercus* sp.), bitter pecan (*Carya illinoensis*), red maple (*Acer rubrum*), and green ash (*Fraxinus pennsylvanica*) with an understory dominated by dwarf palmetto (*Sabal minor*). Where unprotected from flooding, the soils support a "batture" forest composed mostly of willow (*Salix nigra*), sycamore (*Platanus occidentalis*), and cottonwood (*Populus deltoides*).

Progressive increases in the size of natural levees at any point along the Mississippi River and its tributaries are directly related to the degree to which sedimentation (vertical accretion) exceeds subsidence. Hence, time is an important factor. With increasing age, and barring changes in discharge characteristics and sediment load, natural levees will build toward a level that is in equilibrium with those factors. Thus, natural levees are best developed along the flanks of meander belts where they overlie backswamp deposits. In these areas, floodplain aggradation has not been interrupted by the meandering of river bends. In contrast, levees are relatively less well developed where they overlie point bar deposits (lateral accretion). Such is the case in the immediate project area (Figure 7), explaining the narrow width (1 km) as mentioned above. While age estimates are elusive (as discussed later), the levees are thought to be *at least* twice as old over backswamp areas as they are over point bar areas.

Point bar deposits result from the process of meandering, which involves the erosion and caving of outer (concave) banks in bends and the corresponding formation of point bars on inner (convex) banks. In the sub-surface, the point bar deposits extend to the maximum depth of the migrating channel, about 33 to 39 m (108 to 128 ft) below ground surface in the project vicinity. The deposits consist of the bed load of the river, which is mostly gray and brown silts and fine to medium sands, and become slightly finer grained in the upper several meters (laminated clays, silts,

and sands). The contact between the base of the point bar sedimentary sequence and the underlying substratum sand and gravel deposits often is difficult to determine, with some of the latter being reworked and incorporated into the former.

The surface manifestation of point bar deposits typically is one of an alternating series of linear, narrow sandy ridges and clayey swales of similar shape. The orientation of the ridge/swale sequences (sometimes called meander scroll topography) indicates the direction of movement of the parent channel. Above the low water plane of the river, the point bar deposits grade upward into natural levee deposits, in other words, where vertical accretion becomes dominant over lateral accretion. This occurs slowly over time as the migrating channel moves away from a given point.

Except in the narrow bands near the river banks where the natural levee ridges are present, point bar accretion topography is clearly evident on both Manchac and Plaquemine Points (Figure 7). This indicates that Manchac Point has built progressively eastward through most of its length, while Plaquemine Point has built in the opposite direction. At the same time, there has been a slight net downstream migration of both bends within the modern meander belt.

Point bar deposits on both points are veneered with a thin layer of clayey and silty overbank deposits representing either (or both) distal natural levees or backswamp. Soils of the ridges and swales are known to be appreciably different, but because of their narrowness and close spacing, they have not been differentiated on soils maps. In Iberville Parish, the soils of the entire point bar area are classified as Sharkey clay (Spicer et al. 1977), while in West Baton Rouge Parish, they are simply classified as Robinsonville and Commerce soils (Powell et al. 1982). Natural vegetation supported by the soils is a mixture of species typical of both natural levees and batture forests.

Backswamp deposits do not occur in the river banks of the project area; however, they are present in the vicinity (Figure 7) and deserve at least brief mention. Where not capped with natural levee deposits, backswamps are flat, poorly drained, forested tracts underlain by tens of meters of largely unoxidized, gray clays (with some silt layers) laid down in floodbasin areas during times of overbank flooding. Considerable organic matter, ranging from leaves and seeds to stumps, is present throughout the deposits, but layers of pure peat are infrequent. In both parishes, Sharkey clay soils dominate backswamp tracts and these support a swamp forest vegetative assemblage characterized by cypress (*Taxodium distichum*) and tupelo (*Nyssa aquatica*).

Geologic History and Chronology

The peak of the Late Wisconsin glacial stage (or the maximum extent of the Laurentide ice sheet of North America), when sea levels were low and streams deeply incised, occurred about 20,000 to 18,000 years ago. This is a convenient time to begin a landscape evolution scenario, since after that time, events have built progressively toward conditions that have occurred during the time of human occupancy. At about 20,000 to 18,000 years ago, the Mississippi River was flowing in a braided regime and depositing and reworking substratum sands and gravels. In the project area, the floodplain surface was probably on the order of 55 to 60 m (180 to 197 ft) below that of the present and characterized by a sandy plain.

Outwash deposition continued at a high rate and the floodplain aggraded rapidly until about 12,000 to 11,500 years ago. About that time, glacial outflow from the waning Laurentide ice sheet began flowing to the sea via the St. Lawrence River rather than the Lower Mississippi Valley. Influenced by rapidly rising sea level and a sharp and quick decline in discharge and sediment load,

the Mississippi River switched from a braided to an anastomosing or meandering regime. By about 11,000 years ago, it was depositing clays, silts, and sands in backswamp and other overbank environments rather than sands and gravels. Floodplain aggradation continued but at a significantly slower rate. A backswamp environment such as exists today in the Atchafalaya Basin and Spanish Lake Lowland prevailed in the project area.

From about 11,000 to about 5,000 years ago, basic sedimentation patterns did not change in the project area. A backswamp environment persisted, probably oscillating between deep swamp and shallow swamp in response to increases and decreases in the rate of sea level rise. The precise location of the Mississippi River during this interval is not known, but reconstructions of overall patterns of valley alluviation suggest it must have been well west of the project area, probably along the far western side of the valley near the present Teche Ridge (Figure 6) (Saucier 1994). A small meander belt might have existed in the project vicinity, formed by a small stream that conveyed the combined discharges of eastern valley tributaries to the Gulf. Toward the end of this interval, the project vicinity may have resembled the upper end of a shallow, turbid, fresh- to brackish-water estuary.

It is believed that estuarine conditions persisted in the project area until about 4,800 years ago. At that time, and because of a major upstream diversion, the Mississippi River began creating a new meander belt along the eastern side of its valley past the Baton Rouge area (Saucier 1969). Heavy fluvial sedimentation filled the upper end of the estuary and, by at least 4,000 years ago, a meander belt rapidly extended eastward past the project area into the New Orleans area and beyond. This marked the beginning of an early phase of the St. Bernard delta lobe and transformed extensive areas of shallow Gulf into intratidal marshes in southeastern Louisiana (Saucier 1963). Sea level at that time was probably not more than a meter or so below that of the present and slowing rising.

Reconstructions of deltaic plain chronology indicate that, whereas the new meander belt past the project area had become a major river outlet by 4,000 years ago, it did not carry the full river discharge for at least another 500 to 1,000 years. It was not until about 3,500 to 3,000 years ago that the Teche meander belt along the western side of the alluvial valley (Hm₃, Figure 6) was completely abandoned and all flow shifted to the eastern side of the valley.

Hence, some river channel meandering was occurring in the project vicinity and areas of backswamp were being reworked and replaced by point bar accretion by as early as 4,000 years ago. However, it is believed that the initial development of the Manchac and Plaquemine Points did not begin until about 3,000 years ago. Considering the precise location of the project area in relation to the point bar accretion on the points, it is further estimated that the deposits in the Medora Crossing vicinity were not laid down until perhaps 2,500 to 2,000 years ago. It must be emphasized that these estimates are tenuous and extrapolated from a few key valley events: no radiometric age determinations have been made on deposits from this area. The estimates are imprecise, but nevertheless they are based on sound scientific reasoning.

The only attempt to establish a precise (numerical) chronology for river channel positions along the present meander belt has been that of Fisk (1944). Interpreting from his river chronology map of the area (Plate 22, Sheet 15), it is suggested that most of the point bar deposits of the immediate project area were laid down between stages 8 and 12, meaning that they are between about 1,300 and 800 years old. In numerous subsequent studies it has been demonstrated that there are serious problems with some of the basic assumptions underlying Fisk's chronology (Saucier 1994), and his precise age estimates for channel positions generally are not valid. In most cases, they have proven to be far too young.

There are no reasons to believe that there were any significant interruptions in the patterns or rates of meandering and point bar development in the project area between about 3,000 years ago and historic times. During the historic period, changes have been minor. Surveys made prior to the 1880s are not sufficiently accurate and precise to detect bankline changes as small as a few meters. After that time, no changes greater than this are suspected except in one case. Neither the surveys of 1884 (Mississippi River Commission 1884) nor 1935 (U.S. Geological Survey 1935) show a towhead to be present in the project area; however, it is present on a survey dated 1947 (Mississippi River Commission 1947). Surveys for intervening years are known to exist, but were not examined in this study.

In general, it can be said that bank caving and slow, net erosion dominated the north bank of the project area until an artificial revetment was constructed in 1989. Conversely, slow and progressive accretion has dominated the south bank until the present time.

Geoarchaeological Considerations

Answers to two questions must be provided in evaluating the possibility that prehistoric archaeological sites might exist in the project area. First, there is the matter of geomorphic history: are the deposits/landforms old enough to have existed at a particular time and not destroyed by subsequent events (e.g., channel migration)? Second, if deposits/landforms did exist at a particular time and were not subsequently destroyed, would they have been favorable locations for habitation, taking topography, soils, hydrography, and other factors into consideration?

If the chronological scenario described above is valid, no sites of the Paleo-Indian or Archaic stages will exist in the project area. Paleo-Indian hunters could have traversed the glacial outwash plain, but deposits dating younger than 12,000 years have been completely reworked by channel migration in the present meander belt. Archaic-period hunters and gatherers might have ventured into backswamp areas between about 8,500 and 3,500 years ago, but the landscape was not conducive to permanent habitation. Once again, deposits of this age have been completely reworked within the present meander belt.

Formative-stage cultures theoretically *could* have occupied seasonal camps or small settlements on the developing natural levee overlying point bar accretion between about 3,500 years ago and historic times. Because of geomorphic factors, they would have been more likely to occur on the concave (cutbank) side of the river on the highest natural levee close to the channel. They would have been least likely to occur on the lower and more frequently flooded fresh point bars on the convex side of the river. In view of these inferred relationships and this reasoning, prehistoric sites on the natural levee along the north bank of the river at the project area, if present, probably would have been destroyed by bank caving and recession. Possible sites along Plaquemine Point would not be exposed in the south bank at the project area in view of the historic period lateral accretion that has taken place. Hence, this writer feels that the probability is essentially zero that any prehistoric cultural remains could exist in the river bank or channel bottom of the project area.

In historic times, the river channel geometry indicates that most water craft would have moved up or down river close to the north bank. This is where the deepest water would have been and where the plantation landings were located. Vessels that might have wrecked, burned, or sunk while moored would be close to the bank, but this is where an artificial revetment has been built. It is presumed that this construction has precluded any historic craft being present. On the other hand, vessels that might have been adrift in the river likely would have carried by river currents

into the shoal water off Plaquemine Point. Sedimentation in this area could have been heavy enough to cause burial by silt and sand channel deposits.

CHAPTER III

PREHISTORIC CONTEXT

The Medora Crossing Soft Dike Construction project lies within a reach of the Mississippi River at Mile 212.0L in Iberville Parish, Louisiana. This area lies within Management Unit V, and is immediately adjacent to Unit IV, of *Louisiana's Comprehensive Archaeological Plan* (Smith et al. 1983). This chapter briefly describes the prehistoric cultural context of the project region.

Prehistoric Context

The prehistory of Management Units IV and V extends from circa (ca.) 10,000 B.C. - A.D. 1700, and it can be divided into four general archeological stages. Each of these stages (Paleo-Indian [10,000 - 6,000 B.C.], Archaic [6,000 - 1,000 B.C.], Woodland [1,000 B.C. - A.D. 1100], and Mississippian [A.D. 1200 - 1700]) is characterized by common patterns of subsistence and technology (Kreiger 1953; Willey and Phillips 1958). The stages may be divided further into chronologically defined periods and/or phases based on similar sets of artifacts and other cultural traits that are characteristic of a particular geographic region (e.g., Jenkins 1979; Walthall 1980). While different systems have been used over the years to organize and describe the prehistoric culture history of the region (e.g., the Paleo-Indian, Meso-Indian, and Neo-Indian eras used by Neuman 1984), the syncretic stage-period-phase system described by Willey and Phillips (1958) and subsequently refined by Jenkins and Krause (1986) provides the general basis for the discussion presented below.

A total of eight major cultural units can be used to characterize the prehistoric cultural sequence of Management Units IV and V. These units include Paleo-Indian (10,000 - 6,000 B.C.), Archaic (6,000 - 1,000 B.C.), Poverty Point (2,000 - 500 B.C.), Tchefuncte (500 B.C. - A.D. 0), Marksville (100 B.C. - A.D. 400), Troyville-Coles Creek (A.D. 400 - 1200), Plaquemine (A.D. 1000 - 1200), and Mississippian (A.D. 1200 - 1700). Each cultural unit is described below.

Paleo-Indian Stage (10,000 - 6,000 B.C.)

The initial human occupation of the southeastern United States generally is believed to have occurred sometime between 10,000 and 12,000 years ago (8000 - 10,000 B.C.). The earliest inhabitants to occupy this region have been termed Paleo-Indians. Archeological sites dating from this time period are characterized by a distinctive assemblage of lithic tools that include fluted and unfluted lanceolate projectile points/knives, unifacial end and side scrapers, graters, and spokeshaves. In Louisiana, evidence of human activity dating from this time period has been confined primarily to tertiary uplands or floodplain bluffs in the northwestern part of the state. As a result, the probability of identifying evidence of Paleo-Indian activities within the confines of the current project area is extremely low.

The earliest Paleo-Indian culture identified in North America has been named "Clovis," after the type-site in New Mexico. In the western United States, Clovis sites appear to date from a

relatively narrow period, i.e., between 8,900 and 9,500 B.C. (Haynes 1991, Story et al. 1990:178). While the evidence for earlier "pre-Clovis" or "pre-projectile point" occupations continues to be debated among scholars, no such sites have been documented convincingly in North America.

The lithic tool assemblage of the Clovis Culture, and the similar Folsom Culture of the Great Plains and Southern Plains, generally is referred to as the Llano complex. While the Folsom Culture initially was believed to postdate the Clovis Culture, radiocarbon dates from Folsom component sites in Texas have produced dates ranging from ca. 8,000 to 9,000 B.C. (Largent et al. 1991:323-332; Story et al. 1990:189). These dates suggest that the Folsom Culture may be partially contemporaneous with Clovis Culture.

The Plano complex of the Southern Plains represents a similar tradition to the Llano Complex. In East Texas and Louisiana, this complex is represented by unfluted lanceolate, Plainview, Firstview, Hell Gap, and Angostura projectile points/knives. Although these types originally were thought to represent unfluted variants of the Clovis type, radiocarbon dating suggests that they date from a later time period; current models place the Plano complex from ca. 6000 to 8100 B.C. (Turner and Hester 1985:66, 141). Plano-like artifacts have been recovered throughout Louisiana (Cantley et al. 1984; Hillman 1990:206-207).

Another Paleo-Indian tradition identified in North America is the Cody complex. Its stone tool assemblage includes the stemmed, lanceolate Scottsbluff and Eden projectile points/knives. Cody complex bifacial tools usually are identified by the presence of fine comedial pressure flaking. Excavations in the uplands in the Texarkana region of northwest Louisiana, northeast Texas, and southern Arkansas have produced relatively large numbers of Cody Complex artifacts (Gagliano and Gregory 1965:62-77; Story et al. 1990:209). Only limited dating results, however, have been obtained at Cody sites. These dates range from ca. 7100 to 8200 B.C. (Story et al. 1990:209). In contrast, Turner and Hester (1985:149) argue that Scottsbluff projectile points/knives date from ca. 6,650 – 7,120 B.C.

Paleo-Indian peoples are considered by some researchers to have been highly mobile hunter-gatherers organized in small bands or extended family groups. Many models suggest that Paleo-Indian peoples were specialized big game (mega-fauna) hunters. This interpretation, however, has been modified as new data have been recovered from excavations at more Paleo-Indian sites. While sufficient evidence exists to document the exploitation of large mammals (e.g., mammoth, mastodon, bison, caribou, and elk) at sites in the western and northern United States, kill sites in the Southeast are rare.

One exception is the Coats-Hines Site (40WM31), located in the Central Basin of Tennessee. Recent excavations at Coats-Hines (Breitburg and Broster 1995) produced 34 lithic tools, including 10 formal tools and tool fragments along with resharpening flakes, in direct association with the articulated remains of an adult mastodon (*Mammuth americanum*). All of this lithic material was recovered from within the thoracic cavity of the mastodon or in its immediate vicinity. The association of these tools with the skeletal material, along with the presence of distinct butchering marks on a number of the mastodon bones, indicates that Paleo-Indian peoples at the site were butchering mastodon.

The co-occurrence of Pleistocene mega-fauna and several Paleo-Indian projectile points (see Brush and Smith 1994; Clausen et al. 1979; Webb et al. 1984) has led most researchers to accept the interpretation that southeastern Paleo-Indian peoples fulfilled a portion of their subsistence requirements by hunting and/or scavenging the mega-fauna, including bison, mammoth and mastodon, that were present on the North American continent at the end of the Pleistocene (Anderson

et al. 1996). Data such as those derived from the Coats-Hines Site provide unequivocal evidence that Paleo-Indian groups in the Southeast were consuming certain Pleistocene mega-fauna. Current discussions among archeologists, however, have focused on the relative amount of food that these animals provided to Paleo-Indian groups.

Some researchers (e.g. Meltzer and Smith 1986; B. Smith 1986) suggest that Pleistocene mega-fauna comprised only a small portion of the subsistence regime for Paleo-Indian peoples; others argue that mega-fauna provided a substantial portion of the Paleo-Indian diet (Anderson 1995; Anderson et al. 1996). Anderson (1995:151), for example, stated that "modern fauna (i.e., deer and smaller mammalian species like rabbits, raccoons, opossums, etc.) were taken only when mega-fauna were not readily available, and comprised second-line resources." It is likely that unless (or until) more associations of Pleistocene mega-fauna and Paleo-Indian cultural materials and features are identified, the proportion of mega-fauna in the Paleo-Indian diet will not be understood clearly. In addition, although there are few data upon which to base a firm dietary model, Paleo-Indian subsistence throughout the Southeast is believed to have encompassed a broad spectrum of resources, including fish, fowl, deer, small mammals, nuts, and gathered plants, as well as mega-fauna (Smith 1986:9-10; Steponaitis 1986:369; Walthall 1980:36).

The one exception to this generalized subsistence system possibly could be the Folsom Culture. Folsom artifacts consistently have been found in association with bison kill sites on the Great Plains. The lack of faunal evidence from Folsom finds in east Texas and portions of Louisiana, which may be attributed to the poor preservation of bone in the highly acidic soils and moist climate of the region, precludes insights into the subsistence strategies in these areas. The Folsom Culture, however, may represent an adaptation to a specialized hunting strategy associated with the cyclical migration of large herds of bison (Story et al. 1990:189).

Most of the archeological evidence associated with the Paleo-Indian occupation of the southeastern region is limited to surface finds of diagnostic projectile points/knives (Mason 1962). In the Lower Mississippi Valley, Paleo-Indian projectile points/knives have been recovered along valley margins but rarely in alluvial valleys or along the coastal plain. Distributional studies indicate that Paleo-Indian sites in the eastern United States tend to be located on eroded terrace and plateau surfaces (Walthall 1980).

The presence of Paleo-Indian and Early Archaic peoples in the Louisiana is best documented from Maçon Ridge in northeast part of the state. This ridge was created by glacial outwash during the Pleistocene Epoch. It originates at a point near Eudora, Arkansas, and extends southward for approximately 160 km (99.4 mi). The ridge gradually narrows and eventually terminates in the vicinity of Sicily Island, Louisiana. Hillman (1985) provided a prehistoric overview of the Paleo-Indian Stage at Maçon Ridge that suggested that continuous human occupation of the ridge began sometime around 8,000 B.C. Diagnostic projectile points/knives identified at Maçon Ridge date from the Early Paleo-Indian period (Clovis, Sandia II, and unfluted lanceolate points), the Middle Paleo-Indian period (Plainview, Scottsbluff, Quad, Hell Gap, and Pelican), and the later, transitional, "Epipaleoindian" period (Dalton, Hardin, and San Patrice projectile points). The latter nomenclature (Epipaleoindian) originally was assigned by Gibson (1982) to represent the transitional period between the Late Paleo-Indian and Early Archaic periods.

The distribution of recorded sites on Maçon Ridge suggests that this area was occupied more intensively during the Late Paleo-Indian and Early Archaic periods. Sites dating from the Late Paleo-Indian period, such as hunting camps and base camps, typically occur very close to streams, ponds, or sloughs, and on landforms that generally are no more than 1 m (3.3 ft) above a water source. This pattern may indicate a preference for the wooded fringes along the waterways rather than open

grasslands. In contrast, Early Archaic period sites usually occur on higher elevations; this shift may reflect a transformation in the natural setting of Maçon Ridge from an open grassland to an open woodland (Hillman 1990).

Brain (1983) states that Paleo-Indian projectile points/knives have been found along relict channels of the Mississippi River and at remnant Pleistocene surfaces in the floodplain that pre-date ca. 7,000 B.C. In Louisiana, Paleo-Indian sites have been found along Tertiary upland ridges and uplands/floodplain bluffs (Guy and Gunn 1983). Projectile points/knives such as Clovis, Folsom, Scottsbluff, and Plainview have been recovered from these sites. Although the majority of these projectile points/knives have been found in northern Louisiana, a few have been found on late Pleistocene age Prairie Terrace deposits in southern Louisiana.

As of 1983, *Louisiana's Comprehensive Archaeological Plan* listed only two Paleo-Indian sites within Management Unit IV, and none in Management Unit V (Smith et al. 1983:79). The recorded sites within management Unit IV, the Jones Creek Site (16EBR13) and the Palmer Site (16EBR26), were identified relatively close to the current project area in East Baton Rouge Parish. Additionally, a Dalton projectile point/knife and a pair of unfluted Clovis projectile points/knives were recovered from the Garcia Site (16OR34) located on the southeast shore of Lake Pontchartrain in Orleans Parish. The recovery of these projectile points/knives indicates that Paleo-Indian or Early Archaic period peoples may have occupied this area. Lake Pontchartrain represented the shoreline of the Gulf of Mexico during the Pleistocene period (see Chapter II), and it is possible that a majority of the Paleo-Indian Stage sites in this alluvial area currently are underwater or are deeply buried by alluvium.

Archaic Stage (6,000 – 1,000 B.C.)

The term "Archaic" first was coined in the second quarter of the twentieth century as a descriptor for the pre-ceramic cultures that succeeded the Paleo-Indian Stage. The combinations of technological and social developments are associated with the inception of this stage generally are believed to have resulted as adaptations to a warming trend, a drier climate, and a rise in sea level that occurred at the end of the Pleistocene Epoch (Willey and Phillips 1958). These changes have been correlated with the development of highly diverse and localized resource and food procurement strategies (Haag 1971). Caldwell (1958), for example, described the new hunting and gathering specializations of the Archaic Stage as "maximum forest efficiency." Brain (1971) modified this phrase to "maximum riverine efficiency" in reference to the exploitation of southeastern riverine and coastal environments during this time period.

Current data suggest that Archaic Stage peoples moved on a seasonal basis within catchment zones to exploit nuts, fruits, fish, game, shellfish, and other natural resources (Muller 1978). Muller suggested that Archaic societies were characterized by a system of fission and fusion in order to maximize the exploitation of these resources. Macrobands coalesced during the spring and summer months, while microbands exploited the upland ranges during winter (Muller 1978). Archeological data also indicate that Archaic Stage populations exploited a greater variety of terrestrial and marine species than did their Paleo-Indian predecessors. Evidence further suggests that Archaic Stage peoples developed the first semi-permanent settlements yet identified in the archeological record (Neitzel and Perry 1977). Finally, the increased number of identified Archaic Stage sites indicates a probable increase in population throughout the Southeast.

The Paleo-Indian to Archaic Stage transition was accompanied by a change in projectile point/knife morphology. These changes included the emergence of a wide variety of notched and

stemmed projectile point/knife forms and the disappearance of the fluted projectile point/knife type. Nevertheless, archeological evidence suggests that there was some continuity between the adaptations of the Paleo-Indian and the later Archaic peoples who occupied the Southeast (Smith 1986). Archaic projectile point/knife sequences follow a general trend in haft morphology that progresses from side notched to corner notched to stemmed basal forms. Other Archaic Stage flaked stone artifact types included adzes, scrapers, and choppers. During the latter half of this time period, granitic rock, chert, jasper, sandstone, slate, steatite, and scoria were ground and polished into a variety of stone ornaments and tools, which included beads, gorgets, bowls, and celts/axes.

The Archaic Stage may be divided into three subdivisions or periods: Early Archaic, Middle Archaic, and Late Archaic. Each of these periods is discussed below.

Early Archaic Period

In the Southeast, the Early Archaic period generally begins ca. 6,000 – 8,000 B.C. Because of the regional variation and the temporal overlapping of stages, however, a number of researchers view cultural developments in the early portion of this period as transitional in nature between the Late Paleo-Indian and Early Archaic cultures. As mentioned above, Gibson (1982) used the term “Epipaleoindian” to describe this transition. Hillman (1985) included Dalton, Hardin, and San Patrice projectile point/knife types in his review of the transitional period at Maçon Ridge. Dalton projectile points/knives temporally succeeded Clovis projectile points/knives and have been dated between 8,550 – 7,950 B.C. from contexts in Arkansas and Missouri (Goodyear 1982:328). At the Stanfield-Worley Bluff Shelter (1CT125) in northwestern Alabama, the Dalton component dated from ca. 7,750 – 7,050 B.C. (DeJarnette et al. 1962, Griffin 1974). Dalton projectile points/knives also have been recovered in association with Kirk Notched, LeCroy, Rice Stemmed, and Graham Cave projectile points/knives in Horizon 11 at the Koster Site (11GE4) in southern Illinois, which dates from 6,700 to 6,450 B.C. This date range suggests that Dalton projectile points/knives may extend later in time than initially was assumed.

Dalton projectile points/knives sometimes have been recovered in association with bifacially chipped stone adzes that may have been used as woodworking tools. Chipped and ground stone celts, probably the functional equivalent of Dalton adzes, have been recovered from the Kirk Horizon in Zone 16 at the St. Albans Site (46WV27) in West Virginia and from Early Archaic sites in the Little Tennessee River Valley (Smith 1986:14). In Louisiana, artifacts associated with the Dalton Culture usually are restricted to the northern portion of the state.

Some of the earliest recognized Terminal Paleo-Indian/Early Archaic projectile point/knife types identified in Louisiana are the San Patrice, Keithville, and Pelican forms (Webb et al. 1971). San Patrice projectile points/knives originally were ascribed to an area encompassing northwest Louisiana, northeast Texas, and southern Arkansas. More recently, however, San Patrice projectile points/knives have been recovered from sites ranging from central Texas to southwest Alabama, and from southern Louisiana to central Arkansas (Brain 1983:32; Cantley et al. 1984; Giliberti, personal communication 1995).

The San Patrice Culture is believed to represent a regional adaptation of hunter-gatherers to the natural resources of the area. A hallmark of San Patrice is the almost exclusive use of local lithic materials for tool production. Tool assemblages include San Patrice *var. Hope* and St. John projectile points/knives, hafted scrapers, Albany side scrapers, unifacial scrapers, burins, and engravers (Webb et al. 1971). More recently, Keithville *var. A* and *B*, San Patrice *var. Geneill*, and New River projectile point/knife types have been recognized in this assemblage (Brain 1983; Giliberti, personal

communication 1995). Unfortunately, reliable radiocarbon dates for these types are virtually non-existent. Estimates based on tool morphology and stratigraphic position, however, range from ca. 8,050 to 6,050 B.C. (Brain 1983:25; Story et al. 1990:202; Turner and Hester 1985:147; Webb 1981). While Ensor (1986) suggested that the San Patrice projectile point/knife type, and related forms in the Southeast, may have developed from the earlier Dalton projectile point/knife forms, Story et al. (1990:197) argued that both Dalton and San Patrice types evolved from the earlier fluted point traditions.

Subsistence strategies associated with the Early Archaic period probably resembled those of the preceding Paleo-Indian Stage. Early Archaic peoples probably traveled seasonally in small groups between a series of base camps and extractive sites, hunting deer and collecting edible plants (Chapman and Shea 1981; Lentz 1986; Parmalee 1962; Parmalee et al. 1976). The earliest examples of tools associated with food processing, including manos, milling stones, and nutting stones, have been recovered from Early Archaic period sites. Commonly utilized plant foods, such as walnuts, hickory nuts, and white oak acorns, could be hulled and eaten without cooking or additional processing (Larson 1980). Herbaceous seeds, which became an important food source later in the Archaic Stage, generally were absent during the Early Archaic period (Chapman 1977, Lentz 1986). While living floors associated with hearths, shallow pit features, and milling tools are known from the Early and Middle Archaic, there is little evidence of sub-surface food storage or of substantial structures (Steponaitis 1986:371).

Much of our knowledge regarding Paleo-Indian and Archaic lifeways has been limited by problems related to preservation. Lithic tools often are the only surviving artifacts, and they provide only limited information about a narrow range of activities (e.g., manufacture and maintenance of tools, the processing of meat and hides, and the working of wood and bone). Although rarely preserved in the archeological record, clothing, baskets, and other artifacts made from perishable materials such as bone, wood, antler, shell, hair, hide, plant fiber, or feathers, undoubtedly were an important part of the Archaic cultural tradition. Impressions of woven mats and net bags preserved in fired clay hearths from Kirk strata at the Icehouse Bottom Site (40MR23) in Tennessee provide a rare insight into the richness of the Early Archaic period material culture (Chapman and Adavasio 1977).

The Early Archaic cultures immediately preceding San Patrice are understood only poorly in Louisiana. To date, diagnostic projectile points/knives dating from the Early Archaic period, including Cache River, Calf Creek, Kirk, and Palmer, have been recovered largely from questionable contexts, and only in limited numbers. However, one site, the Claiborne Site (22HA501) located in Hancock County, Mississippi, has produced Early Archaic projectile points/knives, including Morrow Mountain and Kirk types (Bruseth 1991). Although Site 22HA501 primarily is known for its Poverty Point affiliation, Greenwell (1984:133) reportedly recovered "a large variety of 'unspecified' Paleo-Indian - Archaic transition and Archaic points..." from a single stratum located beneath features dating from the later Poverty Point occupation. Additional work at this site by Bruseth (1991) also produced Kirk and Morrow Mountain projectile points/knives. Finally, work by Gagliano (1963:12) at "preceramic" sites in southern Louisiana and Mississippi found that Kirk Serrated projectile points/knives were common in the southeastern portion of the state.

Middle Archaic Period

During the Middle Archaic period, new social developments, possibly resulting from widespread environmental changes, affected the development of prehistoric cultures. The effects of continental glaciation subsided, resulting in a warmer and drier climate with modern climatic and environmental conditions prevailing. Technological improvements, including the use of groundstone,

bone, and antler implements, may have been related to adaptations to the changing environment. In some areas, there is evidence of an increased number of ranked societies.

The Middle Archaic period throughout the southeastern United States is marked by several technological advances and by changes in subsistence patterns. Middle Archaic projectile points tend to be stemmed rather than notched. In Louisiana, they include Morrow Mountain, Johnson, Edgewood, and possibly Calcasieu types (Campbell et al. 1990:96; Green 1991; Perino 1985:195). Excavations at Site 16VN791 in Vernon Parish, Louisiana, recovered evidence of a long tradition of corner notched projectile points/knives beginning in the late Middle Archaic. It has been suggested that these points, and others in the region, were derived from types indigenous to central Louisiana (Campbell et al. 1990). Other technological innovations include the appearance of ground, pecked, and polished stone tools, and the use of celts and grooved axes for heavy woodworking, such as dugout canoe manufacture. The *atlatl*, or spear thrower, also first appeared during Middle Archaic times.

The widespread occurrence of plant processing tools such as milling slabs, manos, and nutting stones, suggests an increase in the utilization of plant foods. Comparisons of floral and faunal assemblages recovered from Early and Middle Archaic sites, however, indicate little change in the diversity or relative importance of species utilized. The rough Middle Archaic milling tools used in plant processing all have Early Archaic antecedents (Smith 1986:21).

Acorns and hickory nuts continued to be the dominant plant foods consumed during Middle Archaic times. The remains of *Curcubita* (squash) and bottle gourds, however, appear for the first time during the Middle Archaic. The earliest occurrence of the bottle gourd (*Lagenaria siceraria*) was reported from the Windover Site (8BR246) in Florida and it dated from $5,340 \pm 120$ radiocarbon years B.C. (Doran et al. 1990). "Squash" rinds dating from 5,050 B.C. were recovered from the Napoleon Hollow and Koster sites in west-central Illinois. Although initially identified as the cultivar *C. pepo*, these remains are now thought to consist of the Texas wild gourd, *C. texana*, rather than cultivated squash. Although the seeds of these plants are edible, it appears that their rinds were thin, woody, and inedible; the gourds probably were collected primarily for use as containers rather than as sources of protein. Stronger evidence for the domestication of squash gourds occurs after 2,350 B.C. (Smith 1987).

A significant increase in the utilization of fish and shellfish occurred in many areas during Middle Archaic times. The increasing importance of aquatic resources can be seen in the development of extensive shell middens found along many southeastern rivers. Shell middens first appeared between 4550 and 4050 B.C. during the Hypsithermal (Altithermal) climatic episode. At that time, rivers entered a phase of aggradation and low flow, which promoted the development of oxbow lakes and shallow water shoals. These habitats were favorable for mollusk growth and shellfish collection (Stein 1982). Although the food value of mollusks is low, they can be collected efficiently in bulk and they appear to have dominated the subsistence base for many semi-sedentary Archaic stage groups that resided in the southeastern United States (Russo et al. 1992).

Extensive, deep shell midden sites presumably represent locations that were reoccupied seasonally by small social groups with band-type socio-political organization. Work at other site types likewise suggests the seasonal re-occupation of areas by Middle Archaic peoples. Large cemeteries at some Middle Archaic sites, such as Carlestown Annis (15BT5) in Kentucky and Windover (8BR246) and Little Salt Spring (8SO18) in Florida, included interments made over long periods of time by groups seasonally returning to those locations (Clausen et al. 1979; Milanich 1994). These patterns may have resulted from an increasing population density during the Middle Archaic that may have led to more circumscribed territories. This is indicated both by the repeated

occupation of favored locations and an increased emphasis on locally available raw materials utilized in stone tool production.

Evidence for social stratification during the Middle Archaic was recovered at the Indian Knoll Site (15OH2) in Kentucky (Webb 1946). Grave goods at that location were recovered in association with a child's burial. Because status in egalitarian societies usually was acquired rather than inherited, and because buried children probably did not live long enough to acquire much status, exotic grave objects associated with child burials are seen as one of the earliest indications of inherited social rank.

Late Archaic Period

The Late Archaic period represents a time of population growth as demonstrated by an increased number of sites dating from this time period in the United States. Hallmarks of the Late Archaic period include the production of steatite stone vessels, fiber-tempered pottery, and groundstone artifacts. Each of these artifact classes has been recovered from Late Archaic period sites throughout the Southeast. In Louisiana, projectile point/knife types dating from this time period include both corner notched and stemmed forms.

Throughout the eastern United States, Late Archaic subsistence strategies focused on a few wild resources, including deer, mussels, fish, and nuts. Jenkins (1979) recognized a seasonal procurement strategy in Middle Tennessee during Late Archaic times. In springtime, macrobands formed to exploit forested riverine areas. In late fall and winter, however, Late Archaic peoples fissioned into microbands and subsisted on harvested and stored nut foods and faunal species commonly found in the upland areas. A similar seasonal procurement strategy may have existed in Louisiana.

Late Archaic period projectile point/knife types are commonly found throughout Louisiana. However, very few discrete and intact archeological deposits dating from this time period have been excavated systematically, analyzed, and comprehensively reported (Neuman 1984). Late Archaic sites in the west-central and northern parts of the state that have been studied systematically have produced projectile point/knife types that include Bulverde, Carrollton, Delhi, Ellis, Ensor, Epps, Gary, Kent, Macon, Marcos, Palmillas, Pontchartrain, Sinner, and Yarbrough types. Groundstone objects recovered from these sites include celts/axes, plummets, and steatite bowl fragments (Campbell et al. 1990; Smith 1975; Jeter et al. 1989). Additionally, there is evidence for widespread trade in shell, copper, slate, greenstone, and jasper ornaments, including carved stone zoomorphic locust beads, during Late Archaic times (Blitz 1993; Brose 1979; Smith 1986:31; Steponaitis 1986:374).

Mounds appear for the first time in the Late Archaic some time before 2,000 B.C. (Gibson and Shenkel 1988:9-10). Saunders et al. (1992) believe that mounds erected during this time period are datable based on the age of the landforms, the eluviation of fill clays from the A and E horizons to the Bt Horizon, and a lack of post Archaic artifacts. At present, only four possible Late Archaic mounds or mound complexes have been identified in northern Louisiana (Saunders et al. 1992). These include the Hedgepeth Mounds (Site 16LI7), the Watson Brake Mounds (Site 16OU175), the Frenchman's Bend Mounds (Site 16OU259), and Hillman's Mound (Site 16MA201).

More recently, Saunders (1994, 1996) has hypothesized that mound building may have begun as early as the Middle Archaic Period. The Watson Brake Mound Site (16OU175), located near Monroe, Louisiana, was identified by Northeast Louisiana University student Recca Jones in the

1970s. The site was described as circular in configuration with a diameter of approximately 275 m (900 ft); it encompassed 11 separate mounds, with each mound measuring between 1 and 6 m (3 and 20 ft) in height (Saunders et al. 1997). Well preserved food remains recovered from the site, indicate that the Watson Brake mound group was occupied seasonally for fishing purposes. Recent research by Saunders suggests strongly that the earthworks on the Watson Brake Site are older than previously suspected, and that the mounds were constructed approximately 5,400 years ago. If this date is accurate, the mounds at the Watson Brake Site would represent the earliest example of prehistoric earthwork in North America. This recent discovery contradicts the assumption that Middle Archaic hunting and gathering societies could not achieve the level of social organization necessary for the construction of earthen mound complexes.

In the project region, Late Archaic manifestations on the marginal deltaic plain in the vicinity of the mouth of the Pearl River are classified as the Pearl River phase. Here, oyster shell middens are located along the shorelines and estuaries of the coastal area. This phase may represent the earliest coastal occupation of the region, after sea level approximated its modern stand. Artifacts associated with this phase include various projectile points such as Pontchartrain and Kent, drills, graters, atlatl weights, boatstones, sandstone saws, and hones, most of which were made from gravels and sandstones collected from nearby Pleistocene outcrops and stream deposits. Shell and bone artifacts such as socketed antler tine points also have been recovered, along with fired clay hearth fragments (Gagliano 1963).

Poverty Point Culture (2,000 - 500 B.C.)

Poverty Point represents a transitional culture that originated as early as ca. 2000 B.C. but it did not exert its full influence until much later (Neuman 1984). It is best known for exhibiting several fundamental and distinguishing characteristics of a complex society, including massive public architecture and long distance trade, while still maintaining a hunting and foraging economy. The Poverty Point type site (16WC5) is located adjacent to Bayou Maçon and near several major rivers, including the Mississippi, Tensas, Ouachita, and Boeuf, in West Carroll Parish, Louisiana. This riverine location was ideal for exploiting the flow of trade goods from other regions (Jeter and Jackson 1990:142; Muller 1978; Neitzel and Perry 1977). Evidence for long distance trade recovered at Poverty Point includes ceramics similar to those collected from the St. Johns River region of Florida, and lithic materials from deposits in Arkansas, Illinois, Indiana, Missouri, Ohio, Oklahoma, and Tennessee (Connaway et al. 1977:106-119; Gibson 1974:26; 1994; Jeter and Jackson 1990; Lehmann 1982:11-18; Webb 1982:13-14). These data suggest that Poverty Point Culture may represent the first chiefdom-level society to develop in the eastern United States (Gibson 1985a; Muller 1978).

The Poverty Point type site (16WC5) is distinguished primarily by its large earthworks and its complex microlithic industry. The earthworks include six, 15 to 46 m (50 to 150 ft) wide, segmented ridges that formed five sides of an octagon, and several other mounds scattered throughout the site area. The largest mound, Mound A, resembles the outline of a bird, and it may represent a large-scale effigy (Webb 1982). At the time of its construction, Poverty Point was the largest mound site in the Americas.

The material culture associated with the Poverty Point Culture was distinctive. Typical Poverty Point period projectile points include Carrollton, Delhi, Epps, Gary, Kent, Motley, and Pontchartrain types (Smith et al. 1983:152; Webb 1982:22, 47). Although these point types were in use during the Archaic Stage, they also were manufactured during the Poverty Point period (Gibson 1994). Other artifacts associated with Poverty Point include atlatl weights, plummets, two hole

gorgets, red jasper beads and owl pendants, Jaketown perforators, finger impressed baked clay cooking balls, clay figurines and fetishes, thin micro flints/blades, and food storage and preparation containers (Webb 1982). Container types included sandstone and steatite vessels, basketry, and ceramic items. Most ceramic vessels were sand tempered, although a minority contained grit, clay, or fiber temper or no temper at all. Webb (1982) also reported the recovery of seed processing implements, stone hoe blades, nutting stones, and milling stones from Poverty Point sites.

While Brain (1971) argued that Poverty Point sites tended to be located in the bottomlands, Webb (1982) suggested that they occurred on four different landform types: (1) Quaternary terraces or older land masses that overlook major stream courses; (2) areas along major river levees of active or relict river channels; (3) tracts of land at river-lake junctions; and (4) along coastal estuaries or older land surfaces located within a coastal marsh area. Such areas were ideal for exploiting forest-edge resources and for transporting exotic materials. Sites on these landforms ranged in size from large ceremonial centers to small hamlets or foraging stations.

Poverty Point Culture as expressed in southern Louisiana has been separated into several phases that reflect chronological and geographic distinctions associated with materials recovered from Poverty Point period sites. East of the current study area, the Bayou Jasmine and Garcia phases, ranging in date from 1,500 – 1,000 B.C. and 1,000 - 500 B.C., respectively, have been identified (Kidder et al. 1995; Weinstein and Kelley 1992). Sites from each phase generally are characterized as shell middens located along the shoreline of Lake Pontchartrain. Materials recovered from these sites suggest that the inhabitants practiced seasonal and specialized adaptations to marsh environments. Bayou Jasmine Phase sites are located on the western shore of the lake, and along the natural levee ridges of the Mississippi River distributaries. Garcia phase sites are located along the eastern shore of Lake Pontchartrain.

The Garcia Site (16OR34), the type site for the Garcia phase, is located on a buried natural levee adjacent to a former channel of the Mississippi River. This site contained a beach deposit of *Rangia* shells and midden debris. Materials collected from this site have been used to date both the Garcia and the Bayou Jasmine phases of the Poverty Point period in southeastern Louisiana (Gagliano 1963; Gagliano and Saucier 1963). Bayou Jasmine Phase sites, such as the type site located along the western shore of the lake, contain Poverty Point objects, food bones and bone artifacts, and "an undistinguished stone complex which does not include the typical Poverty Point microlithic assemblage" (Phillips 1970:874; Duhe 1976). In contrast, Garcia phase sites, as exemplified by the Garcia Site alone, include no Poverty Point objects, but exhibit a more complex lapidary industry including the presence of polished stone artifacts such as boatstones, celts, and plummets, and a complex microlithic industry (Gagliano and Saucier 1963; Phillips 1970:874). Although Phillips (1970) and others have raised questions regarding the precise chronology of the period, they have noted that the chronological distinctions between the Garcia and Bayou Jasmine phases are real and that they have provided one of the few known breaks in the Poverty Point Culture sequence. Additional radiocarbon dates are necessary in order to clarify the absolute chronology of these phases.

Woodland Stage (1,000 B.C. - A.D. 1100)

Despite the many innovations it introduced, the Poverty Point culture typically is portrayed either as a Late Archaic period or a pre-Woodland Stage transitional manifestation. The emergence of the true Woodland Stage in Louisiana was characterized by a combination of horticulture, the introduction of the bow and arrow, and the widespread use of ceramic containers. The Woodland Stage includes three periods: Early Woodland, Middle Woodland, and Late Woodland. In Louisiana,

the Early Woodland period (ca. 500 B.C. - A.D. 0) is represented by the Tchefuncte Culture, the Middle Woodland period (ca. 100 B.C. - A.D. 400) is associated with the Marksville Culture and to a lesser extent with the Troyville Culture, and the Late Woodland period (ca. A.D. 400 - 1200) originated with the Troyville Culture but was dominated by the Coles Creek Culture. A discussion of each of these cultures is presented below.

Tchefuncte Culture (500 B.C. - A.D. 0)

While Tchefuncte Culture is characterized by the first widespread use of pottery, its tool inventory otherwise resembled that of a Late Archaic period hunter-gatherer tradition (Byrd 1994; Neuman 1984; Shenkel 1981:23). The culture first was identified at the type site (16ST1) located on the north shore of Lake Pontchartrain in St. Tammany Parish, Louisiana (Ford and Quimby 1945; Weinstein and Rivet 1978). Later, the Tchefuncte Culture was defined by Ford and Quimby (1945) based on Works Progress Administration (WPA) excavations at Big Oak Island (16OR6) and the Little Woods Site (16OR15) in Orleans Parish during the 1930s and 1940s. While the Tchefuncte Culture initially was thought to represent a localized adaptation by an indigenous population in the southern Louisiana coastal region (Ford and Quimby 1945), Tchefuncte or Tchefuncte-like ceramics have been recovered from southeast Missouri, northwest Mississippi, the Yazoo Basin, coastal Alabama, and east Texas (Brookes and Taylor 1986:23-27; Mainfort 1986:54; Neuman 1984; Webb et al. 1969:32-35; Weinstein 1986:102).

A date range from ca. 500 B.C. - A.D. 100 generally has been accepted for the Tchefuncte period; more recent research, however, indicated that dates for the Tchefuncte period differ widely from region to region and occasionally within the same area (Byrd 1994; Gibson 1976a, 1976b: 13; Webb et al. 1969:96; Weinstein 1986). Most archeologists agree that the Tchefuncte Culture dates from as early as 700 B.C. in the south, that it diffused to the north where it is known as the Tchula Culture, and that it terminated around A.D. 100 (Gibson and Shenkel 1988:14; Perrault and Weinstein 1994:48-49; Shenkel 1974:47; Toth 1988:19). Recent evidence suggests that coastal Tchefuncte sites may have survived until ca. A.D. 300 (Byrd 1994:23, Neuman 1984:135). These dates suggest that the last remaining coastal Tchefuncte communities were coeval with sites associated with the late Marksville Culture (Toth 1988:27-28).

Tchefuncte/Tchula ceramics usually are characterized by a soft, chalky paste and a laminated appearance in cross-section. They were fired at low temperatures and they were tempered either with sand or clay (Phillips 1970). Vessel forms consist of bowls, cylindrical and shouldered jars, and globular pots that sometimes exhibit podal supports. While many vessels are plain, some are decorated with punctations, incisions, simple stamping, drag and jab, and rocker stamping. Punctated types usually are more numerous than stamped types, but parallel and zoned banding, stippled triangles, chevrons, and nested diamonds also occur. During the later part of the Tchefuncte period, red filming also was used to decorate some vessels (Perrault and Weinstein 1994:46-47; Phillips 1970; Speaker et al. 1986:38). Tchefuncte/Tchula ceramic types include Alexander Incised, Wheeler Simple Stamped, Wheeler Punctated, Jaketown Simple Stamped, three Tchefuncte types (Plain, Stamped, and Incised), and Lake Borgne Incised (Ford, Phillips, and Haag 1955). In addition, Ford, Phillips, and Haag (1955) identified a variety of fiber tempered and fiber impressed ceramic types.

For the most part, the stone and bone tool subassemblages characteristic of the Tchefuncte Culture remained nearly unchanged from those of the preceding Poverty Point period. Stone tools included boat stones, grooved plummets, chipped celts, and sandstone saws; bone tools included awls, fish hooks, socketed antler points, and ornaments. In addition, containers, punches, ornamental artifacts, and some tools such as chisels were manufactured from shell. Projectile point/knife types

characteristic of Tchefuncte Culture include Gary, Ellis, Delhi, Motley, Pontchartrain, Macon, and Epps types (Ford and Quimby 1945; Smith et al. 1983:163). Bone and antler artifacts, such as points, hooks, awls, and handles, also became increasingly common during this period.

Inland Tchefuncte/Tchula sites generally are classified as villages or hamlets, although shell middens also have been identified. Settlement usually occurred along the slack water environments of slow, secondary streams that drained bottomlands and floodplain lakes (Neuman 1984; Toth 1988:21-23). Both burials and artifacts recovered at Tchefuncte period sites suggest an egalitarian social organization. Tchefuncte/Tchula peoples probably operated at the band level, with as many as 25 to 50 individuals per band. The widespread distribution of similar ceramic types and motifs may imply a patrilocal residence pattern with exogamous band marriage arrangements (Speaker et al. 1986:39). Social organization probably remained focused within macrobands, and hunting, collecting, and fishing remained integral to the Tchefuncte/Tchula way of life.

Data recovered from shell midden sites dating from Tchefuncte times document the wide variety of food resources utilized during the period. Faunal remains recovered from these sites include deer, opossum, muskrat, raccoon, otter, bear, fox, dog, ocelot, wildcat, alligator, bird, fish, shellfish, and turtle (both aquatic and terrestrial). Recovered plant remains (all non-domesticated) include squash, gourds, plums, nuts, grapes, and persimmons (Neuman 1984; Smith et al. 1983). Neuman (1984) noted that the remains of crustaceans such as crabs, shrimp, and crawfish do not appear in the Tchefuncte/Tchula middens.

An examination of faunal and floral remains recovered from the Morton Shell Mound (16IB3), a coastal Tchefuncte shell midden, suggested that some coastal sites were occupied on a seasonal basis only; available data revealed that the Morton Shell Mound probably was occupied during the summer and autumn, and possibly during the spring (Byrd 1994:103). The preponderance of freshwater fish remains at sites such as Big Oak Island (16OR6) and Little Oak Island (16OR7) indicates a reliance on aquatic resources (Shenkel and Gibson 1974).

In coastal Louisiana, six phases have been defined for the Tchefuncte period. These consist of the Sabine Lake Phase (southeast Texas and southwest Louisiana); the Grand Lake Phase (Grand Lake and Vermilion Bay area); the Lafayette Phase (the Atchafalaya basin west of Vermilion River); the Beau Mire Phase (below Baton Rouge in the Ascension Parish area), and the Pontchartrain Phase (Lake Maurepas and Lake Pontchartrain in the Pontchartrain Basin) (Weinstein 1986:108). Only the Pontchartrain and Beau Mire Phases are relevant to the current project. The Pontchartrain Phase is generally assumed to have predated the Beau Mire Phase, with proposed date ranges of ca. 500 B.C. to ca. 250 B.C. for Pontchartrain and 250 B.C. to A.D. 1 for Beau Mire; however, these dates have not been accepted by all scholars (Kidder et al. 1995:35).

Marksville Culture (100 B.C. - A.D. 400)

The Marksville Culture, named for the Marksville Site (16AV1) in Avoyelles Parish, Louisiana, often is viewed as a local manifestation of the midwestern Hopewellian tradition that extended down the Mississippi River from Illinois (Toth 1988:29-73). Complex geometric earthworks, conical burial mounds for elites, and unique mortuary ritual systems indicate a highly organized social structure during Marksville times. Some items, such as elaborately decorated ceramics, were manufactured primarily as mortuary furniture. Burial items included pearl beads, carved stone effigy pipes, copper ear spools, copper tubes, galena beads, and carved coal objects. Toward the end of the Marksville period, Hopewellian influences declined, and mortuary practices became less complex (Smith et al. 1983; Speaker et al. 1986).

Ceramic decorative motifs such as cross-hatching, U-shaped incised lines, zoned dentate rocker stamping, cord-wrapped stick impressions, stylized birds, and bisected circles were shared by potters in the Marksville and Hopewell cultures (Toth 1988:45-50). Other Marksville traits include a stone tool assemblage of knives, scrapers, celts, drills, ground stone atlatl weights, plummets, medium to large stemmed projectile points, bone awls and fishhooks, and baked clay balls. Additionally, a variety of non-local artifacts commonly found at Marksville sites suggests the existence of extensive trade networks and possibly a ranked, non-egalitarian society. Some commonly recovered items include imported copper earspools, panpipes, platform pipes, figurines, and beads (Neuman 1984; Toth 1988:50-73).

Little currently is known about Marksville subsistence strategies. Presumably, Marksville peoples employed a hunting, fishing, and gathering subsistence strategy much like those associated with earlier periods. Oily seeds (marsh elder, sunflower, curcubits) and starchy seeds (chenopodium, wild bean, maygrass, knotweed, little barley) also were consumed (Fritz and Kidder 1993:7; Smith 1986:51). At the Reno Brake Site (16TE93) in Tensas Parish, Kidder and Fritz (1993) recovered the remains of deer, squirrel, rabbit, bird, and fish as well as acorns, persimmon, palmetto, grapes, blackberries, and very minor amounts of chenopodium and sumpweed. Although maize has been identified and dated from Middle Woodland contexts at sites in Tennessee and Ohio (Ford 1987), it probably was not important in Louisiana until Mississippian times (Fritz and Kidder 1993:7 and 294; Smith 1986:50-51).

Gagliano (1979) has argued that Marksville subsistence strategies were organized around cyclical and seasonal activities that involved two or more shifting camp sites. In southern Louisiana, shellfish collecting stations located on natural levees and lower terraces around Lake Pontchartrain and Lake Maurepas were utilized during the summer months. During the winter, however, semi-permanent hunter-gatherer camps were occupied on the prairie terrace. This subsistence strategy is consistent with fission and fusion patterns that appear to have originated during the Archaic times.

Troyville-Coles Creek Period (ca. A.D. 400 - 1200)

Troyville Culture, elsewhere described as Baytown, was named after the Troyville mound group (16CT7) in Jonesville, Catahoula Parish, Louisiana. It represents a transition from the Middle to Late Woodland period that culminated in the Coles Creek Culture (Gibson 1984). Though distinct, Troyville and Coles Creek cultures are sufficiently similar that many researchers group them as a single prehistoric cultural unit. According to Neuman (1984:169), 23 C¹⁴ dates from 14 Troyville sites in Louisiana place the beginning of the period at approximately A.D. 395. Continuing developments in agriculture and the technological refinement of the bow and arrow during this time period (reflected by the appearance of Alba, Catahoula, Friley, Hayes, and Livermore projectile point types), radically altered prehistoric life. During the Troyville cultural period, bean and squash agriculture may have become widespread. This shift in subsistence practices probably fostered the development of more complex settlement patterns and social organization.

The Late Woodland Coles Creek Culture emerged from the Troyville Culture around A.D. 750, and it represented an era of considerable economic and social change in the Lower Mississippi Valley. By the end of the Coles Creek period, communities were larger and more socially and politically complex. Large-scale mound construction occurred and there is evidence for the resumption of long-distance trade on a scale not seen since Poverty Point times. These changes imply that chiefdoms were reemerging in the Lower Mississippi Valley (Muller 1978). The possible diffusion of material and sociopolitical concepts from the Midwest may be indicated by the fact that Coles Creek ceramics have been recovered from early Cahokian contexts in southeastern Missouri

dating from ca. A.D. 900 (Kelly 1990:136). These changes probably initiated the transformation of Coles Creek cultural traits into what now is recognized as the Plaquemine Culture sometime before A.D. 1200 (Jeter et al. 1989; Williams and Brain 1983).

Ceramic vessels of this time period are distinguished by their grog and grog/sand tempering. Decorative motifs include cord marking, red filming, and simplified zoned rocker-stamping, as well as decorations with incised lines and curvilinear lines. The Coles Creek peoples continued to use Troyville wares, with some elaborations (McIntire 1958). For instance, the Churupa Punctated and the Mazique Incised designs, both of which are characteristic of the Troyville Culture, were used by both Coles Creek and later Plaquemine pottery makers (McIntire 1958). Similarly, French Fork Incised, which formed the basis for many Troyville classifications, continued to be used well into the Coles Creek period (Phillips 1970).

Coles Creek peoples also developed a new ceramic complex that included larger vessels and a wider range of decorative motifs, usually positioned on the upper half of the vessel (Neuman 1984). Coles Creek Incised, Beldeau Incised, and Pontchartrain Check Stamped are typical examples of these wares (Phillips 1970; Weinstein et al. 1979). One distinctive decorative type, Coles Creek Incised, contains a series of parallel-incised lines placed perpendicular to the rim of the vessel, often accompanied underneath by a row of triangular impressions (Phillips 1970:70; Phillips et al. 1951:96-97). Several of the ceramic motifs reflect outside cultural influences. French Fork Incised motifs and decorative techniques, for example, mimic almost exactly Weeden Island Incised and Weeden Island Punctated types from the Gulf Coast of northwest Florida (Phillips 1970:84; Phillips et al. 1951:101; Willey 1949:411-422). Pontchartrain Check Stamped ceramics also appear at the same time as the resurgence of the check stamped ceramic tradition of the Weeden Island III period in northwest Florida (Brown 1982:31).

Sites from the Coles Creek cultural period were situated primarily along stream systems where soil composition and fertility were favorable for agriculture. Natural levees, particularly those situated along old cutoffs and inactive channels, appear to have been the most desired locations (Neuman 1984). Most large Coles Creek sites contain one or more pyramidal mounds. Coles Creek mounds typically are larger and exhibit more building episodes than the earlier Marksville burial mounds. While burials occasionally are recovered, the primary function of the Coles Creek mounds appears to have been ceremonial. At some Coles Creek sites, mounds are connected by low, narrow causeways; plazas occasionally are associated with these multiple mound sites (Gibson 1985b). According to Williams and Brain (1983), these traits indicate Mesoamerican influences.

The complexity of the Coles Creek mound system suggests a social structure capable of supporting a centralized authority with a sizable labor force to build and maintain the mounds. A non-elite population probably occupied the region surrounding the large ceremonial centers (Gibson 1985b; Neuman 1984; Smith et al. 1983). In general, small Coles Creek sites consist mostly of hamlets and shell middens, and they normally do not contain mounds.

Recent work has dispelled the old theory that an intensification of agriculture, particularly maize (*Zea mays* spp. *mays*) and squash (*Cucurbita pepo*) cultivation, comprised the subsistence base of the Coles Creek Culture. Although Coles Creek populations exhibit tooth decay rates consistent with a diet based on starchy foods such as maize, the limited archeobotanical evidence for maize in Coles Creek midden deposits suggests that consumption of some other starchy foods may be the cause (Kidder 1992; Steponaitis 1986). While researchers speculate that cultigens, especially squash species, were harvested by Coles Creek peoples, evidence of dependence on domesticated plants has been lacking at early Coles Creek sites (Kidder and Fritz 1993; Kidder 1992). The preponderance of evidence now available indicates that the cultivation and consumption of maize

was not widespread in the Lower Mississippi Valley until after the Coles Creek period, ca. A.D. 1200 (Kidder 1992:26; Kidder and Fritz 1993).

Earlier assumptions about the nature and extent of social and political differentiation during Coles Creek also must be re-examined. Square-sided, flat-topped mounds that are believed to have served as platform bases for elite structures first appear during Coles Creek times. Evidence for elite residential or mortuary structures often said to be associated with these mounds, however, remains elusive prior to A.D. 1000 (Kidder and Fritz 1993; Smith 1986; Steponaitis 1986). Nevertheless, both the form of the platform mounds and their arrangement around plazas may be indicative of Mesoamerican influence (Willey and Phillips 1958; Williams and Brain 1983).

Numerous sites with Troyville-Coles Creek components have been recorded in Management Units IV and V (Smith et al. 1983). In a literature search for sites located in the vicinity of Pearl River, for example, Heartfield, Price and Greene, Inc. (1982) identified two sites (Site 16ST06 in St. Tammany Parish, Louisiana, and Site 22HA500 in Hancock County, Mississippi) that contained Baytown/Troyville cultural components. They also identified two sites (16WA06 and 16WA25) in Washington Parish that contained Coles Creek components (Heartfield, Price and Greene, Inc. 1982).

Mississippian Stage (A.D. 1200 - 1700)

The Mississippian Stage represents a cultural climax both in population growth and social and political organization for those cultures occupying the southeastern United States (Dye and Cox 1990; Phillips 1970; Williams and Brain 1983). The advent of the Mississippian Stage is represented at sites throughout the Lower Mississippi Valley and along the northern Gulf Coast. Mississippian period sites are recognized by a distinctive complex of traits that include shell tempered ceramics, triangular arrow points, copper-sheathed wooden ear spoons, and maize/beans/squash agriculture (Williams and Brain 1983). Mississippian sites containing large "temple mounds" and plazas have been recorded throughout the Southeast at such places as Winterville, Transylvania, Natchez, Moundville, Bottle Creek, and Etowah (Hudson 1978; Knight 1984; Walthall 1980; Williams and Brain 1983).

In the Lower Mississippi Valley, the Mississippian Stage includes the Plaquemine or Emergent Mississippian period (ca. A.D. 1200 - 1450) and the Late Mississippian period (ca. A.D. 1450 - 1700). Each of these periods is described below.

Emergent Mississippian Period (A.D. 1200 - 1450)

The Emergent Mississippian period - Plaquemine Culture appears to represent a transitional phase from the Coles Creek Culture to a pure Mississippian Culture (Kidder 1988). The emerging Mississippian cultures of the Central Mississippi Valley probably exerted enough influence during the latter part of the Coles Creek period to initiate the cultural changes that eventually defined the Plaquemine Culture. Plaquemine peoples continued the settlement patterns, economic organization, and religious practices established during the Coles Creek period; sociopolitical structure and religious ceremonialism, however, were intensified. This suggests, among other things, a complex social hierarchy. Large ceremonial sites that typically contained multiple mounds surrounding a central plaza were constructed. Smaller dispersed villages and hamlets also formed part of the settlement hierarchy (Neuman 1984).

Although Plaquemine ceramics are derived from the Coles Creek tradition, they display distinctive features that mark the emergence of a new cultural tradition. In addition to incising and punctating pottery, Plaquemine craftsmen also brushed and engraved their vessels (Phillips 1970). Plaquemine ceramic types include Plaquemine Brushed, Leland Incised, Hardy Incised, L'Eau Noire Incised, Anna Burnished Plain, and Addis Plain. Plaquemine Brushed appears to have been the most common ware type (Kidder 1988:75).

Gregory (1969) reports that Plaquemine sites in the Catahoula basin demonstrate a propensity toward settlement in lowland areas, including swamps and marshes. This position is supported by both Jeter (1982) and Schambach (1981) in reference to southeast Arkansas and the Felsenthal region of that state. In contrast, Neuman (1984) cites Hall's observation that Plaquemine sites in the upper Tensas Basin were located most frequently on well-drained natural levees characterized by sandy soils. In the Boeuf Basin, Kidder and Williams (1984) note that Plaquemine components frequently overlie earlier Coles Creek occupations.

In the vicinity of the project area, Shannon (1989) identified a ceramic sherd with a "Southern Ceremonial Complex" (i.e., open hand and eye) motif during the Phase I assessment and delineation of the Johnson Site (16ST68) in St. Tammany Parish, Louisiana. This motif is a hallmark of the Mississippian period. Subsurface shovel and auger testing also identified *in situ* features at the site that Shannon interpreted as the remains of a Mississippian house site (Shannon 1989).

Late Mississippian Period (A.D. 1450 - 1700)

As early as A.D. 1450, several traits that now are definitive of the Mississippian period were wide-spread across most of the Southeast. These diagnostic traits include well-planned mound groups, a wide distribution of sites and trade networks, a revival in ceremonial burial of the dead, and production of shell tempered ceramics (Griffin 1990:7-9), an innovation that enabled potters to create larger vessels (Brain 1971; Steponaitis 1983). Ceramic vessel forms include globular jars, plates, bottles, pots, and salt pans. Additionally, loop handles appeared on many Mississippian vessels. Although utilitarian plainware was common, decorative techniques included engraving, negative painting, and incising; modeled animal heads and anthropomorphic images also adorned ceramic vessels. Other Mississippian artifacts include chipped and groundstone tools; shell items such as hairpins, beads, and gorgets; mica and copper items; and projectile point types such as Alba and Bassett.

Mississippian subsistence was based on cultivation of maize, beans, squash, and pumpkins, on collection of local plants, nuts, and seeds, and on fishing and hunting of local species. Major Mississippian sites were located on fertile bottomlands of major river valleys, in terrain characterized by sandy and light loam soils. A typical Mississippian settlement consisted of an orderly arrangement of village houses surrounding a truncated pyramidal mound. These mounds served as platforms for temples or as houses for the elite. A highly organized and complex social system undoubtedly existed to plan these intricate communities.

In the Pearl River basin, Heartfield, Price and Greene, Inc. (1982) identified two sites (22HA515 and 22HA529) in Hancock County, Mississippi, and one site (16WA08) in Washington Parish, Louisiana, that contained Mississippian period components. A total of eight Mississippian sites were reported in Assumption and St. Charles parishes by Smith et al. (1983), and two additional Mississippian period sites (16ST168 and 16ST170) in St. Tammany Parish were reported by Hays in 1995 (Hays 1995).

Protohistoric and Historic Period (A.D. 1539 - 1730)

Understanding the protohistoric and historic Native American cultures of the southeastern United States is severely limited by a frequent inability to recognize the ancestral cultures from which these groups were derived. The centralized Mississippian chiefdoms described by the Spanish participants of the de Soto *entrada* of A.D. 1539-1543 no longer existed when the French explorers Marquette, Joliet, and La Salle penetrated the Mississippi River valley in the late seventeenth century. In their stead were dispersed autonomous villages composed of various remnants of several native groups.

The social and demographic collapse in the Mississippi River valley, as elsewhere in the southeast, is attributed to a number of factors. European-introduced diseases spread quickly in the densely populated chiefdom communities. The rapid depletion of older members of society led to a loss of tradition and, quite conceivably, many of the specialists. In addition, decimation of the young prevented regeneration on the scale required for chiefdom society. Pressures from European colonization on the Eastern seaboard forced many coastal indigenous populations to migrate further inland, disrupting, integrating with, or decimating other native groups. Reorganization of small remnant bands resulted in the integration of several traditions on a less complex scale of economy (Galloway 1994; Hudson and Tesser 1994).

The Mississippi River served as a major thoroughfare during the dynamic protohistory of Louisiana. A number of Native American groups, migrating north, south, east, or west from their previous settlements, are known to have interacted with each other as well as with the French, Spanish, and English colonists and their African slaves. By 1699, the threat of English fur and deerskin traders in the Mississippi Valley prompted the French Ministry of Marine to establish a post at Biloxi Bay under the direction of Iberville (Usner 1994:13-17). Although Iberville visited villages of Biloxis, Pascagoulas, Mactobis, and Capinas, as well as clusters of Mobilians and Tohome along the Gulf Coast, he observed scores of deserted villages further inland and those with inhabitants showed evidence of epidemic disease.

According to *Louisiana's Comprehensive Archaeological Plan* (Smith et al. 1983), three Native American linguistic groups occupied Management Unit IV at the time of European contact: Muskogean, Siouan, and Tunican. Muskogeans generally were concentrated within the Pearl River and Lake Pontchartrain regions, although they were found throughout the area comprising Management Unit IV; Muskogean speakers identified within this management unit include the Acolapissa, migrating Choctaw, and the Pensacola. The Siouan speaking Biloxi, along with the Pensacola, occupied the Pearl River area (Giardino 1984). The Tunica moved to Louisiana from northwest Mississippi and eventually settled near the confluence of the Mississippi and Red rivers in the early eighteenth century. Giardino (1984) stated that the Colapissa resided near present-day Slidell from 1705 to 1712 and that a group of Colapissa and Nassitoch were inhabitants in the vicinity of Bayou Castine, north of present-day Mandeville, in 1705.

The use of early historic accounts to extrapolate information concerning the Native Americans in the lower Mississippi valley is illustrated by Swanton's (1946) documentation of the Acolapissa. According to Swanton (1946), the name Acolapissa refers to "those who listen and see", or the "borders" or "scouts". This group also was referred to by several other names in the early French accounts. Le Page du Pratz (Swanton, citing Le Page du Pratz 1758:219) called this group the Aquelou pissas, La Salle referred to them as the Cenepisa (Margry 1876-86:564) and the name Kolapissa was used by Gravier (French 1875:88). Colapissas was the name used in 1699 by Penicaut and the spelling variant, Coulapissas by Sauvole in 1700 (Swanton 1946 citing Margry 1875-86:462).

The earliest known location of the Acolapissa is about eleven miles above the mouth of the Pearl River. By 1702 they relocated to Castembayouque (Castine Bayou). Iberville noted the Acolapissa were located in six villages; the Tangipahoa, close relatives of the Acolapissa, lived in a seventh. Penicaut reported the Acolapissa moved to the east side of the Mississippi River about 13 leagues from New Orleans. By 1739 they had merged with the Bayougoula and Houma (Swanton 1946).

The Bayougoula, a Muskogean group, were one of the first Native American groups to meet Iberville in 1699. By 1739 they had moved up the Mississippi River and were living between the Acolapissa and Houma. They eventually merged with the Houma, Quinipissa, and Mugulasha, though they had suffered attacks from the Houma. Other groups of Native Americans moving into Louisiana near the vicinity of the project area included bands of Alabama, Apalachee, Biloxi, Mugulasha, Natchitoches, Okelousa, Opelousa, Pensacola, Tangipahoa, and Tawasa. The Avoyel, or "people of the flint", also referred to as Tassencogoula, or "flint people", were noted as middlemen in the trade between Mobile and points north along the Mississippi and Red Rivers. They also were known as Little Taensa due to their trade relations with the Taensa (Swanton 1946).

Life in the villages, hamlets, and farmsteads of these native groups in French Louisiana revolved around the seasonal rounds associated with hunting, fishing, gathering wild resources, and cultivating the domestic plants nurtured by the nebulous ancestors that previously presided in the Mississippi River valley. Those groups who lived directly in the floodplain of the river devoted their subsistence activities to the procurement of the abundant fish, turtles, mammals and wild plants in the area. Village life in the upland terraces focused more on the horticulture of corn, beans, and squash, though the hunting of white-tailed deer and other mammals was an important occupation. Although the economy of the Native Americans in French Louisiana was deeply rooted in the hunting, gathering, and horticulture developed over thousands of years, the introduction of the French mercantile system transformed their subsistence economy to one of commodity exchange (Usner 1992).

French settlers first interacted with the Native Americans to acquire food. Soon, however, the need became apparent to form alliances with the native groups for trade and military balance. The chief export in the earliest years of the French colony was deerskins. The interconnected interior waterways of bayous and lakes in southern Louisiana provided an avenue for the flow of an estimated 50,000 deerskins a year to the ports of New Orleans and Biloxi. Outposts along these trade routes functioned as marketplaces and social gathering places. By 1726 the French had established trade alliances with most Native American villages within a 350- further inland mile radius of New Orleans, while to the north, Fort Rosalie was established among the Natchez to stifle English encroachment on the fur and deerskin trade of French Louisiana.

The necessity of this alliance between the French and the Native American groups in the lower Mississippi valley was underscored by the demographics of the new colony. In 1718 no more than three to four hundred French soldiers, officers, and other royal employees resided in the entire French-occupied Gulf Coast. By 1726, approximately four thousand non-Native Americans inhabited the settlements and outposts of Louisiana compared with 35,000 inhabitants in Native American villages (Usner 1992:44-46). This native population represented mere remnants of the groups that formerly inhabited the area prior to their decimation by disease and warfare. Those native communities called *petites nations*, located near the centers of colonial population such as New Orleans and Mobile, provided daily goods and services to the French, yet sought to preserve their political, economic, and social autonomy by remaining on the fringes of colonial society. Although many members of the *petites nations* converted to Christianity, they were essentially less socially integrated with the French colonists than those larger groups such as the non-Christianized Choctaw

with whom the French sought to establish formal diplomatic relations (Usner 1992:45). The formal alliances were necessary to equalize French military power with that of the English who were allied with the Chickasaw and to protect French fur and deerskin trading interests in the lower Mississippi River valley. Hostilities between the Choctaw and Chickasaw were encouraged with bounties paid for each Chickasaw scalp. In 1721 Governor Bienville acknowledged that such hostility between the two powerful Native groups would prevent a Choctaw-Chickasaw alliance that would have threatened the outnumbered colonists (Usner 1992:65).

CHAPTER IV

HISTORIC CONTEXT

The project area is located at the Medora Crossing on the Mississippi River in Iberville Parish, Louisiana. A "crossing" refers not to a ferry but to the swerving of the main current of the river. As the river rushes around Manchac Point into the project area, the force of the current is concentrated on the left descending bank of the Mississippi at river mile 212 opposite Medora Plantation.

Since early in the nineteenth century, both sides of the river at the study site have been associated with staple crop agriculture, particularly cane growing and sugar production. The name "Medora" was applied only after 1867 to the plantation, which had been cultivated for many years. A guide to landings in 1881 identified Medora's plantation house, built of brick with white columns, as a landmark on the river (Cayton 1881:27-28).

Early Exploration

Although early sixteenth century Spanish voyagers initiated the European discovery of the Mississippi River, a French explorer in the seventeenth century challenged Spanish claims to the region. René Robert Cavalier, Sieur de la Salle, sailed downstream from Canada to the river's mouth, where, in 1682, he claimed the Mississippi Valley for France. To establish a French colony in Louisiana, the French royal government in 1698 sent Pierre Le Moyne, Sieur d'Iberville, to explore the Mississippi River further. Iberville's exploration of Bayou Manchac had considerable significance for the future settlement of the project area.

The Alternate Route to the Gulf of Mexico, 1698-1763

Iberville extensively investigated the Bayou Manchac (which he named the Rivière d'Iberville) just upriver from the study site (McWilliams 1981). Although filled with obstructions, this passageway provided a possible alternate route to the Gulf of Mexico. Trappers could bypass the difficulties of navigating the lower Mississippi River by shipping their furs to the Gulf through Bayou Manchac, the Amite River, Lake Maurepas, and Lake Pontchartrain.

The possibility of a lake passageway intrigued all the major powers that contended for control of North America. Before the development of steam-powered vessels, sailing ships had difficulty ascending the Mississippi River against the current. Treacherous sandbars presented another obstacle. A lake passageway upriver would eliminate part of these problems. Even more importantly, a passage through the lakes had considerable strategic importance as a means of circumventing the authority of the nation that held New Orleans and controlled the mouth of the Mississippi. When the Spanish obtained New Orleans in 1763 after the French and Indian War, the British in West Florida took a decided interest in developing a route through Lakes Ponchartrain and Maurepas that would connect fledgling British settlements on the Mississippi to Mobile and Pensacola on the Gulf of Mexico (Dalrymple 1978:6-7).

Fortifying the Alternate Route, 1763-1769

The Treaty of Paris that concluded the French and Indian War in 1763 completely altered European control of the lower Mississippi Valley and the Gulf of Mexico. Under the terms of the treaty, the French were expelled not only from Louisiana, but from all North America as well. The British obtained the Floridas from Spain. The new British colony of West Florida extended westward to the Mississippi River; Bayou Manchac and the alternate route formed the new colony's southern boundary. The Spanish received former French territory west of the Mississippi River as well as the so-called Isle of Orleans (the city of New Orleans and former French territory east of the Mississippi River up to Bayou Manchac and the passage through the lakes to the Gulf).

The Peace of Paris transferred both the left descending and right descending banks of the Mississippi at river mile 212 from France to Spain; just a few miles above the project area on the east bank, Bayou Manchac served as the boundary between the new British colony of West Florida and Spanish territory to the south. As a result of potential conflict between Britain and France, the hitherto deserted and unpopulated neighborhood of the project area assumed a new strategic importance.

In 1764, the British made the first attempt to strengthen their presence in the vicinity of the project area by building Fort Bute. Unfriendly Native Americans hampered the initial construction effort and the fort was not completed until 1766. This stockade was established about 400 yards north of Bayou Manchac on the left bank of the Mississippi River. An authority on Louisiana fortifications, Powell A. Casey, identified the site of the fort as in either Section 45 or Section 46, Township 8 South, Range 1 East, in today's East Baton Rouge Parish; however, he cautioned his readers that the river may have swept the site away. Subsequent archeological investigation uncovered the likely location (16EBR55) of the British fort. Imperial concerns elsewhere as well as discouragement about the alternate route led the British to abandon the fortification in 1768 (Casey 1983:34).

The Spanish responded to the threat of Fort Bute by erecting their own fortification south of Bayou Manchac on the left descending bank of the Mississippi River. Known as Fort San Gabriel de Manchak, the structure was begun in April 1767 and completed in 1768. After the British abandoned Fort Bute in 1768, the Spanish in 1769 withdrew from Fort San Gabriel. The building at the site of Fort San Gabriel and the surrounding acreage were turned over to six German families. According to Powell Casey, the site of the fort was located in Section 2, Township 8 South, Range 1 East, Iberville Parish. The left bank of the project area lies just downstream in Section 6, Township 8 South, Range 1 East, Iberville Parish. Although Casey believed that the site of Fort San Gabriel also probably had been washed away by the Mississippi River (Casey 1983:193), an archeological investigation has uncovered possible remains (161V140) of the Spanish fort.

Acadian Settlement in the Project Vicinity, 1767

To protect its boundary against Great Britain, the Spanish government next established Acadian refugees at Fort San Gabriel and vicinity. These French-speaking refugees had been expelled from Canada by the British; after taking temporary refuge in Maryland, the first group of Acadians arrived at St. Gabriel on August 17, 1767. Included in the first group was an immigrant whose name the Spanish recorded as Diego Hernandez. He later would claim the land that would evolve into Medora Plantation (Riffel 1985:4-5).

The Antecedents of Medora Plantation, 1775-1866

The plantation that preceded Medora stretched like a belt across the waist of Manchac Point; both the northern and southern tips of the plantation were located on the Mississippi River, which winds eastward and then westward around the tip of the point. The upper portion of the plantation lay in Section 92, Township 8 South, Range 12 East, in today's West Baton Rouge Parish; the lower portion was located in Section 2, Township 9 South, Range 1 East, in Iberville Parish.

Situated near the boundary established in 1763 between the Spanish colony of Louisiana and British West Florida, the formerly French territory at Manchac Point had a decidedly mixed population of French, Spanish, and English settlers with the French-speaking Acadian colonists tending to form a fourth separate group. In 1775, the Spanish government granted to Basticus Quidres (also known as Bartie Quindre) the first land patent on Manchac Point (Original Acts of Iberville Parish, Book A-1, Act 32, dated July 17, 1780, Iberville Parish Courthouse; Lowrie and Franklin 1834:2:352). From his large land grant, Quidres, presumably Spanish, in turn conveyed the site of the future Medora Plantation to Diego Hernandez (Original Acts of Iberville Parish, Book A-2, Act 32, dated July 17, 1780).

Although his name in the official records certainly sounded Spanish, Hernandez' real surname was Arnaudèse; he was a refugee from Acadia, via Maryland. The 28 year old Arnaudèse, with his wife and daughter, came to Louisiana with the first shipload of Acadians that arrived at St. Gabriel in 1767; their daughter, Margarita, actually was born on the voyage from Baltimore to Louisiana. Hernandez (aka Arnaudèse) was assigned to farm number 4 at St. Gabriel (Voorhies 1973:428-429,432).

Judith, the 23-year-old wife who in 1767 immigrated with Hernandez to Louisiana, died in Louisiana. Hernandez then married Marie, the daughter of Joseph Landry, a leader of the Acadian colony in the vicinity of St. Gabriel (Original Acts of Iberville Parish, Book A-1, Act 75, Iberville Parish Courthouse). By 1780 Hernandez had acquired the property on Manchac Point where Medora Plantation would be established many years later.

In 1781, Joseph Simon Dupuy acquired the Diego Hernandez tract on the right descending bank of the project area (Original Acts of Iberville Parish, Book A-5, Act 17, Iberville Parish Courthouse). The property would remain in the possession of the Dupuy family until after the Civil War.

Joseph Simon Dupuy had migrated from Acadia and had married on March 27, 1769, another Acadian immigrant, Anne Marie Hebert. A Spanish census of Iberville in 1771 recorded Joseph's name and that he was listed as a member of the militia in 1777. Although Dupuy acquired the Hernandez property in 1781, he did not retain the property very long, for he died a few years later.

Joseph Dupuy's succession, dated March 2, 1785, indicated that his tract on the west bank of the Mississippi measured six arpents along the river with a depth of 40 arpents. The land was cleared and contained a house and a storage shed. An inventory recorded the following livestock: a pair of oxen; one horse; four cows; four bulls; two calves; a ewe and a lamb; 23 pigs; and, 27 fowl. His personal property included a plow and a yoke, two guns, a saddle and bridle, a grindstone, a tub, a spinning wheel, a pair of card and a bale of cotton, part of which was being made into cloth. The inventory listed various household items such as pots, pans, dishes, glasses, bowls, a pitcher and funnel, a table with six chairs, two irons, a mirror, a trunk, a completely furnished bed, a packet of candles, several old books, and cash in the amount of 55 piastres (Riffel 1985:216). The bale of cotton recorded in the inventory provides a clue to the staple crop being raised on the plantation at the time.

A son, Joseph Aubry Dupuy, inherited Joseph Simon Dupuy's land. Born in 1770, Aubry Dupuy attained the rank of major in the War of 1812 and was thereafter known by that title. Major Dupuy was twice-married and had many children (Riffel 1985:216-217).

By the late 1820s, agriculturalists in Iberville Parish were switching from staple crops such as cotton to cane growing and sugar manufacture. One statistic records this increasingly popular trend: in 1828 there were 19 sugar producers in Iberville Parish; in the next year the number had increased to 45 (Degelos 1892:65-68). Many other farmers in Iberville who could not afford the expensive machinery to manufacture sugar nevertheless shifted to cane growing in search of a new source of wealth. Although he did not produce sugar in 1829, Aubry Dupuy formed a partnership with N. Landry in 1830; in that year the partners manufactured 30 hogsheads of sugar. Dupuy and Landry were listed in West Baton Rouge Parish on the northern portion of Manchac Point, just above the Iberville Parish line 116 miles above New Orleans (Degelos 1892:65).

Major Dupuy lived an exceptionally long life and died in 1858 a respected member of the community. In his latter years, his eldest son, Baltazar Dupuy, managed the acreage that served as the predecessor to Medora on the west bank of the project area.

Born in 1795, Baltazar Dupuy lived until 1867 and fathered 15 children by his three wives. As a teenager he enlisted in the Eighth Regiment during the War of 1812; as a grown man, he served for nine years, from 1823 to 1832, as Sheriff of Iberville Parish (Riffel 1985:214). Under Baltazar Dupuy's direction, the plantation on the west bank of the project area, which he does not seem to have named, enjoyed its most prosperous days.

A severe crevasse occurred at the plantation in 1851 (Riffel 1985:61), but Dupuy's agricultural establishment recovered from the loss. By 1860, Baltazar Dupuy reported in the census that he owned 88 slaves, whom he housed in 40 dwellings. He listed his acreage as 515 improved, 985 unimproved. He valued his real property at \$122,000, his personal property (which should have included slaves) at \$22,000. He owned the following livestock: 12 horses; 45 asses and mules; 9 cows; 14 working oxen; 75 sheep; 45 swine; and, 20 other cattle. His plantation raised 15,000 bushels of corn, but the census taker neglected to record any staple crops such as cotton or sugar cane (Menn 1964:244-245). Nevertheless, the annual statement of the sugar crop reveals that Baltazar Dupuy actively engaged in sugar planting from 1844 until the Civil War severely disrupted agricultural operations along the Mississippi River. His sugar house utilized steam rather than horses to power its operations. His last harvest before war devastated the operation produced 290 hogsheads of raw sugar. Nevertheless, his sugar production never compared to the output of more affluent Louisiana planters, who produced more than 1,500 hogsheads of sugar annually (Champomier 1862).

One of Baltazar Dupuy's 15 children, Oscar, recorded in a letter of June 16, 1863, some of the difficulties experienced at the plantation and its vicinity during the Civil War:

The negroes have all left their owners in this parish. Some planters have not even one servant left. Our wives and daughters have to take the pot and tubs; the men, where there are any, take to the fields with the plough and hoe....Father [Baltazar Dupuy] had eighty five negroes gone for a while, but about twenty have returned since. All his house servants have gone except Sarah the cook...Octave [another of Baltazar's sons] is overseeing at father's, and is well and hearty....The Yankees have filled up all the plantations from Plaquemine to father's place with negroes [i.e., contrabands]....There are nine hundred of them there, mostly old men, women, and children, and the worst of it is that they have all kinds of diseases amongst them, and

they die like flies. There is no doubt they will bring in this neighborhood all kinds of sickness amongst us (Riffel 1985:214-215).

Medora Plantation, 1868 to the Present

Baltazar Dupuy survived the Civil War, but he lost an immense investment with the emancipation of the slaves. On April 4, 1866, one year before his death, he sold his plantation to A. Woods. According to Norman's *Chart of Mississippi River Plantations*, the Dupuy holdings in 1858 stretched entirely across Manchac Point, from riverfront to riverfront (Norman 1858). In the postbellum era the upper or northern portion of the property was detached from the lower or southern part, and two plantations each with their own waterfront were created from the Dupuy holdings. Only the lower or southern portion has relevance to the study site. When Woods purchased the property, the land and improvements included:

twenty three mules, three old horses, one blind mare, two colts, thirteen head of horned cattle, fifteen hogs, twenty sheep, forty ploughs and gears, two harrows, three flukes, seven horse carts, two ox carts, four bagasse carts, one set of blacksmith tools, one lot of carpenter tools, one lot of hoes, spades, and axes, one pair of scales, one hundred and fifty cords of fire-wood, sixty sugar hogsheads, fifty molasses barrels, a lot of staves and hoops, a lot of old iron, lots of hides in tan, three barrels of lime on turning lathe and tools, twelve cross cut saws, three mill saws, a lot of saw logs, a lot of pickets and posts, a lot of log chaws, a lot of blocks and tackles, and fall. One iron windlap, a lot of ropes, and cable, seed cane sufficient to plant fifty or sixty acres, one old pair timber wheels, ax chains and yokes, and a lot of bricks for the amount sum of \$13,950.00 [sic throughout] (Book 8, Act 214, Iberville Parish Courthouse).

The above inventory indicates that, besides planting cane and sugar culture, the Dupuy plantation engaged in a variety of other activities, including tanning, carpentry, blacksmithing, and logging.

Lewis Woods assumed direction of the Dupuy Plantation in 1868, renaming it Medora. During his tenure, which lasted until 1876, the plantation once more engaged in sugar manufacture. Medora's sugar house was built of brick with a shingle roof and a steam mill. It utilized the closed kettle system. Unfortunately for the new owner, sugar output in the postbellum period never equalled the production of the pre-Civil War years. Besides the financial problems inherited from the military conflict, plantation agriculture was harmed by severe overbank flooding, perhaps due to neglect of levee repair during the Civil War (Goodwin et al. 1990:32-33).

A study incorrectly reports that sugar production at Medora virtually ceased after Lewis Woods sold the plantation in 1876 to Charles Norville Roth, Jr., and R. McWilliams (Goodwin et al. 1990:33). In fact, Roth and McWilliams improved Medora's sugar house and its machinery, and its output increased. Cane growing also continued on the property, as Chart 67 of the Mississippi River Commission's survey of 1879-1880 indicated.

In 1881, Medora still had a landing on the Mississippi. The brick plantation house with its white columns served as a landmark on the river (Cayton 1881:27-28). The structure may have been built by Baltazar Dupuy during the more prosperous antebellum era. The Mississippi eventually encroached upon the site of the house. A particularly harmful flood occurred in 1882, when the water rose 31.30 feet on the Plaquemine gauge. Because of numerous breaks in the levee, a local historian has called the flood of 1882 "the most disastrous high water in the history of the parish [Iberville]" (Grace 1946:53).

In spite of floods, Roth and McWilliams continued to produce sugar. The partners harvested 500,000 lbs of sugar in 1891 (Bouchereau 1891:72). The owners of Medora jointly held several other plantations and they operated Roth and McWilliams, a large mercantile establishment (Riffel 1985:326-327).

Nevertheless, throughout the remainder of the nineteenth century, the underbank of Manchac Point was slowly eroded by the river. As the south bank of Manchac Point eroded, agriculture at Medora was abandoned. C. N. Roth, Jr., retired to New Orleans in 1901 (Riffel 1985:326). By 1921, woods and undergrowth covered all the plantation beyond the levee, and the main buildings of the plantation were enclosed within the levee (Goodwin et al. 1990:39-40).

The bank line continued to erode throughout the twentieth century. In 1932, the Atchafalaya Basin Levee Board constructed a levee across Manchac Point that left the point vulnerable to flooding. Landowners were forced to move their structures or abandon them prior to levee construction. Those houses not moved were torn down. After this exodus, all of Manchac Point became wooded and overgrown. The land at the point was cultivated no longer (Goodwin et al. 1990:39).

A pronounced change in the project vicinity occurred in 1956 when the Dow Chemical Company began building a large complex approximately two miles above Plaquemine. By 1964 Dow Chemical comprised 11 factories and represented the largest industry in Iberville Parish (Iberville Parish Development Board 1964:65).

In summary, flooding, bank line erosion, and the construction of levees impacted historic structures and land use at the site of Medora Plantation on Manchac Point. The buildings that survived from an earlier period were moved or washed away as the twentieth century progressed.

The Conrad-Towles Plantation

In his description of the geography of Louisiana in the early nineteenth century, William Darby pointed out that the agricultural establishments on the west bank in Iberville Parish had a marked superiority to those located on the east bank (Riffel 1985:9). His observation certainly holds true for those plantations adjacent to the project area. Although neither was situated ideally, Medora Plantation fared better than the Conrad-Towles Plantation across the river, which was developed much later and had far less success in sugar production. Furthermore, very little information has survived about the operations of the Conrad-Towles place.

The land on the east bank of the project corridor was not converted to sugar cane cultivation in 1829 and 1830, when so much of the parish (and the planters across the river) began to seek their fortunes in sugar production (Degelos 1899). According to Charles J. Pike's 1847 *Map of Mississippi River Plantations*, far fewer plantations had been established on the east bank of Iberville Parish than on the west bank (Riffel 1987:50). Furthermore, the publication that records the antebellum sugar crop in Louisiana indicated that no cane growing or sugar production was being undertaken on the east side of the river at study site (Champomier 1844-1845:2). By 1850, however, F. B. Conrad and a Dr. Towles had established a cane plantation and a horse-powered sugar mill at the site. The partners had converted their sugar factory to steam by the time of the Civil War (Champomier 1850-1862; Henry and Jerodias 1857::2).

F. B. Conrad can be identified as Francis or Frank Conrad. He was younger brother to Frederick D. Conrad, a sugar magnate who lived in a mansion on the Cottage Plantation eight miles above the project area in East Baton Rouge Parish (Irion et al. 1993:22). Frank Conrad, an absentee

planter, lived in New Orleans, practiced law, and lived in a fashionable neighborhood on Prytania Street, between First and Philip streets (Cohen's *New Orleans and Lafayette Directory* 1849). Although then situated in the community of Lafayette, the neighborhood eventually was annexed into New Orleans, where it became known as the Garden District.

Frank Conrad continued to practice law in New Orleans until 1851. He apparently died young for 1852 only Mrs. H. J. Conrad was listed at the Prytania Street address (Cohen's *New Orleans and Lafayette Directory* 1851; 1852). Mrs. Conrad continued to live in New Orleans. Her dwelling was recorded as 593 St. Charles Avenue in 1860 and 458 Camp Street in 1870 (Gardner's *New Orleans Directory* 1860; 1870). Her son, Frank B. Conrad, a clerk, resided with her at the latter address. Like her husband, she remained an absentee landowner in the project area. Chart #67 of the Mississippi River Commission mapped the project area and its vicinity in 1879-1880. The map indicated that a Mrs. Conrad and one G. E. Towles continued to own adjoining properties at the site, but they did not appear to be engaged in joint operations during the postbellum era. Unlike her neighbors, Mrs. Conrad cultivated only corn or wheat on her acreage.

Dr. Towles has proven more difficult to identify. Maps and statements of the sugar crop in the antebellum era do not give his first name. Louisiana's census of 1850 recorded four heads of household with the surname Towles but only one, a Conrad Towles, resided in Iberville Parish; the others were listed in East Baton Rouge, West Feliciana, and Ouachita parishes. The given name "Conrad" suggests the possibility that the Towles of Iberville could have been related in some way to F. B. Conrad, as well as his partner, but neither supposition can be proved. The Charles Towles of East Baton Rouge Parish may be the same Charles Towles who succeeded Dr. Towles in the management of the plantation after the Civil War (Jackson and Teeple 1978). Nevertheless, neither a Charles Towles nor a Conrad Towles was recorded in the index to the Louisiana Census of 1860 (Jackson 1981). Louisiana's Census of 1870 listed no heads of family of the surname Towles or Towle, but a Charles Towles was recorded in Bayou Goula, Iberville Parish, downriver from the project area (Jackson 1983).

In the decade before the Civil War, Dr. Towles and Conrad compiled an uneven record of sugar production. On the eve of the Civil War in the season of 1860-1861, when planters on the east bank had a particularly discouraging season, the Conrad-Towles partnership produced 140 hogsheads of sugar, a respectable showing (Champomier 1861:10). In the following year, the last sugar crop before Federal invasion interrupted agricultural operations, Conrad and Towles produced only 54 hogsheads of sugar, a poor output (Champomier 1862:10). In the same season, upriver plantations on the east bank recorded the following productions; Magnolia Mound, 525 hogsheads; Gartness, 550 hogsheads; Arlington, 400 hogsheads; and, Cottage Point, 600 hogsheads (Champomier 1862:7).

Although some minor clashes between the Federals and Confederates occurred at the village of Plaquemine, no recorded hostilities occurred in the project area. Nevertheless, like its counterpart across the river, the Conrad-Towles plantation had difficulty resuming operations after the Civil War.

The Civil War ended in 1865, but cane growing and sugar production was not attempted on the former Conrad-Towles place until 1870. By that time, Charles Towles had succeeded Dr. Towles in management of the plantation.

Charles Towles had a sugar house that was built of brick and shingle and utilized steam power and the kettle system. In 1870, the first year in which the plantation appeared in the postbellum statement of the sugar crop, Towles had no yield whatsoever (Bouchereau 1870:20).

As in the antebellum period, sugar production flourished more readily on the west bank of Iberville Parish than on the east. In 1871, 76 sugar growers were recorded on the west bank, but only 42 were listed on the east bank (Bouchereau 1871:14-15).

Charles Towles obviously had difficulty producing a sugar crop. He manufactured only 35 hogsheads in 1871 (Bouchereau 1871:14). By 1875 he was replaced on the plantation by Nalle and Cammack, who produced 130 hogsheads (Bouchereau 1875:22). In the following year, John O'Neill (whose surname was variously spelled) was listed as the proprietor of the former Conrad-Towles plantation. He changed its name to St. Mary. He produced 76 hogsheads in 1876 (Bouchereau 1876:22). Charles Towles apparently continued a much smaller operation on a portion of the property. In 1880, O'Neill was recorded as producing 65 hogsheads, while Charles Towles produced 5 hogsheads (Bouchereau 1880:22). Towles and O'Neill had separate landings for their establishments in 1881 (Cayton 1881:33).

In 1881, both O'Neill and Towles were listed as producers of refined sugar. O'Neill's yield was recorded as 92 hogsheads; Towles' output was listed as 6 hogsheads (Bouchereau 1881:57). Like all of Iberville Parish, the plantations on the east bank were affected by the severe flood of 1882 (Grace 1946:53). By 1890, sugar production at the former Conrad-Towles location had ceased altogether (Bouchereau 1890:4). Maps indicate that in the latter part of the nineteenth century, the river was encroaching upon the original structures of the plantation, including the sugar house. New levees built farther inland during the 1890s left some of these structures unprotected from the river.

Although sugar manufacture ended at the plantation the growth of cane as a staple crop continued well into the twentieth century. The cane was transported elsewhere for manufacture into sugar. Chart #67 of the Mississippi River Commission Map of 1921 shows the east bank adjacent to the project area divided into small farms with few structures. Gamine Anselmo, Ignace Sanchez, Jim Granada, Paul Granada, and Tony Anselmo were listed as proprietors; the Granadas occupied the location of the former Conrad-Towles property. The 1921 map did not indicate any structures on the property; earlier buildings may have been abandoned, destroyed, or swept away by the river.

CHAPTER V

MARITIME HISTORY

Throughout the prehistoric and historic periods, the Mississippi River has been a major artery of transportation. Watercraft of all descriptions, from dugout canoes to the great "floating palaces" of the nineteenth century, have plied its waters. The river is also an extremely treacherous body of water with many natural hazards. Chief among these are shifting sand bars and snags formed from large trees that have washed into the river. Literally hundreds of vessels have been lost as a result of fires, explosion, warfare, collisions with other vessels, or as a result of natural disaster or human error. Others merely were abandoned when their useful lives had expired, while others served as floating wharves until they deteriorated and sank. These maritime activities have left a substantial archeological legacy along the Mississippi River and its tributaries, one that offers unique insights into both the material culture and evolution of transportation along the river.

The earliest watercraft used in the area most likely were simple log rafts or even individual logs. At some point in time, the aboriginal inhabitants of the region began to construct dugout canoes. Some of these canoes were large enough to hold between 75 and 80 passengers, seated three across. The remnants of De Soto's ill-fated expedition destroyed a number of these and smaller canoes in the "vicinity of Head of Passes in present-day Plaquemines Parish, Louisiana" (Pearson et al. 1989: 70-71). Three such canoes have been found in Louisiana waters: the Fluker's Bluff Dugout Canoe, on display at the Museum of Geoscience at Louisiana State University, the Lake Salvador Dugout Canoe, now at Acadian Village in Lafayette (Terrel n.d.); and the Red River Dugout Canoe on display at the Louisiana State Exhibit Museum in Shreveport. Radiocarbon dates have been assigned to all three canoes. The Fluker's Bluff Canoe was dated from ca. 1240 A.D. Three dates have been derived for the Lake Salvador canoe: 410 ± 90 B.P. (1540 A.D.), 330 ± 80 B.P. (1620 A.D.), and 300 ± 80 B.P. (1650 A.D.). The Red River canoe has been dated by radiocarbon between 1005 and 1065 A.D. (Phillip Rivet, personal communication 1993).

The Mississippi River in the vicinity of the project area has served as a major avenue for European exploration and commerce since Pierre Le Moyne, Sieur d'Iberville, first ventured upstream to the mouth of the Red River in 1699. French traders passed through the project area on their way between the settlements of Biloxi and Mobile and the Illinois country even before the establishment of New Orleans in 1718. Bayou Manchac, which enters the Mississippi River approximately 16 miles below the project area, served as a major communication link between Mobile and the Mississippi River, particularly after it was freed of obstructions in the 1760s. By providing a water connection to the Gulf of Mexico via the Amite River, Lake Maurepas and Lake Pontchartrain, the long and difficult passage across the bars blocking the mouths of the Mississippi could be avoided. This route, however, required portages, which limited the size of the craft that could negotiate this route.

The French quickly adapted the Native American dugout canoe, or *pirogue* to their own use. Carved from a single cypress log, *pirogues* could reach up to 15 m (50 ft) in length and carry 50 tons of cargo.

During the eighteenth century, *bateaux* eventually supplanted the pirogue as the most common freight carrier employed on the river. The term *bateau* was freely applied to numerous vessel types and forms describing small to moderate sized sailing cargo vessels. The variant generally associated with inland waterways was flat-bottomed, double ended and carvel-built. They generally were propelled by oars or poles but could be fitted with sails (Chapelle 1951:34-35).

With the influx of Anglo-American settlers into Louisiana from the Ohio Valley during the late eighteenth century, flatboats and keel boats became a common sight on the Mississippi River. Flatboats, also known as arks, family boats, flats, Kentucky boats, New Orleans or Orleans boats, and broadhorns, were constructed as rectangular boxes with low cabins. They were propelled essentially by the current of the river and guided by long sweeps. Flatboats were a cheaply constructed, one-way means of transportation that usually were broken up and sold for timber once they reached their destination.

Unlike the flatboat, the keelboat was designed for two-way travel. The keelboat and the barge, a somewhat larger vessel type, were built on a keel with frames covered with planks. They were narrow, double-ended vessels with a cabin amidships. Propulsion was provided by poles in shallow water, by oarsmen stationed in the bow, or, if conditions permitted, a square sail. A long steering oar at the stern guided the vessel.

The arrival of the first steamboat in New Orleans on January 10, 1812, revolutionized river transportation. Although flatboats and keelboats continued in use for many years to come, it was the steamboat that was largely responsible for the rapid expansion of Americans into the West during the first decades of the nineteenth century. Freed of the constraints of current and wind, steamboats permitted the establishment of regularly scheduled packet service from New Orleans to the gateways to the West at St. Louis, Cincinnati and Pittsburgh.

Captain Henry M. Shreve is credited generally with developing the distinctive form of the western river steamboat. Typically, these vessels were shallow draft and almost flat bottomed. Because of their shallow depth of hold, engines and cargo were carried on the main deck. Passengers were quartered on the boiler deck above the main deck. Larger steamers might also boast a Texas deck, and a hurricane deck. The tier of decks was topped by the pilothouse.

Steamboats on the Mississippi River normally were driven by two high-pressure horizontal steam engines. Steam pressure in excess of 100 pounds per square inch (psi) was required to drive the vessels against the flood of the Mississippi whereas 15 psi was the more common operating pressure of engines propelling vessels along rivers and bays in the east. The high steam pressure required to drive the engines challenged the technology of the day to contain it. As a result, boiler explosions were all-too-frequent occurrences.

River steamers typically were propelled by paddle wheels in order to maintain their shallow draft. Paddle wheels were mounted either on the stern of the vessel or slung from outriggers called guards on the sides. The more maneuverable side-wheelers were preferred on the Mississippi where the width of the river was not a limiting factor. Side-wheel steamers would have churned through the project area well into the twentieth century.

The rapid extension of railroad lines after the Civil War spelled the beginning of the end of the Steamboat Era. The low freight charges offered by the railroads diverted much of the bulk hauling business away from steamboats in the waning years of the nineteenth century.

The internal combustion engine fomented another revolution in the history of navigation. By the 1920s, gasoline-powered towboats were handling a dramatic increase in bulk material cargoes (Owens 1990:155). The towboats delivered their cargoes of coal, oil, gasoline, sand, gravel, cement, or brick on wooden barges.

CHAPTER VI

ARCHEOLOGICAL POTENTIAL OF THE PROJECT AREA

According to nineteenth century directories, river landings existed at both Medora Plantation and the Conrad-Towles Plantation until at least 1881 (Cayton 1881). Whether the landings were dismantled or simply deteriorated through disuse is unknown. The proximity of Medora Plantation and the Conrad-Towles Plantation to the project area correlates with a high probability for submerged cultural resources. These resources could take the form of small vessels used at the plantations, abandoned vessels, structures associated with boat landings, and materials lost or discarded in the river at or near these landings. Due to the variety of activities, which took place at river landings, there also could be significant deposits of artifacts associated with these activities. However, the potential for artifact deposition must be considered in the context of the tremendous levels of energy exhibited by the river, particularly during times of flood. The probability that artifacts, unless they are particularly large or well anchored to the bottom have been periodically re-deposited can not be overlooked. Evidence of the river's power of translocation is clearly visible in Figure 5 (Bottom), which shows the steel-hulled pushboat *Joseph* deposited at a considerable distance from the water's edge by recent flooding. The condition of this vessel's bow suggests that it had been submerged for quite some time before the river carried it to its present resting place.

Waterborne Commerce in the Project Area

The Wreck of the Melodeon

Cayton's *Landings* in 1881 indicated that Dr. Towles' plantation landing was situated 114 miles above New Orleans on the east side of the Mississippi River. Furthermore, the landing was located "opposite Wreck of *Melodeon*" (Cayton 1881:33).

The *Melodeon* was built in Cincinnati, Ohio in 1849. A side-wheel packet with wood hull, the vessel weighed 244 tons. On its maiden voyage in the spring of 1849 the *Melodeon* plied the waters between Louisville and St. Louis. Late in 1850 the vessel had departed from New Orleans and was headed for Nashville, Tennessee, when an accident occurred (Way 1994:318). According to "Lytle's List," the *Melodeon* collided with the *George W. Kendall* near Plaquemine, Louisiana on December 14, 1850 (Lytle 1952:237).

The *George W. Kendall*, built in Wheeling, West Virginia, in 1849, had several serious accidents in the four years it sailed the Mississippi River. Measuring 182 feet in length x 32 feet in breadth x 8 feet in depth, the vessel weighed 280 tons. First the *Kendall* collided with *Melodeon*; several persons drowned, and the *Melodeon* sank after the mishap. The catastrophe did not end the misadventures of the *Kendall*. On February 6, 1853, the vessel hit a barge of molasses near St. Joseph, Missouri; the barge sank with the loss of 1,600 barrels. A few weeks later, on February 27, 1853, the

Kendall ran on the rocks in Louisville, Kentucky, where it remained stranded for two or three months. It was then dismantled rather than repaired (Way 1994:186).

As previously mentioned, "Lytle's List" gives the date of the *Melodeon's* sinking as December 14, 1850 (Lytle 1952:237). Various directories, guides, and databases have copied Lytle's entry. Nevertheless, research in a contemporary newspaper has failed to confirm the date. The New Orleans *Daily Bee* for December 1850 has no reference to the accident. The Crescent City newspaper carried extensive coverage of other steamboat accidents on the Mississippi at the time, including the explosion and loss of life that occurred December 13 on the towboat *Anglo-Norman*, the catastrophic explosion of December 17 on the steamer *Knoxville*, and the running aground and sinking on December 20 of the steamboat *Talleyrand*. The *Talleyrand* sank near Bayou Goula in Iberville Parish, about ten miles below the project area (New Orleans *Bee*, December 14, 18, 23, 1850. If a New Orleans newspaper would carry an account of the sinking of the *Talleyrand*, with no loss of life, the newspaper might be expected to publish details of an accident that supposedly happened at the same time and cost three lives. To add to the puzzle about the date of the *Melodeon's* accident, the New Orleans *Bee* gives no indication that the *Melodeon* was docked in New Orleans in early December before the accident. For these reasons, the date reported in "Lytle's List" must be called into question, even though it has been repeated in subsequent sources (Detro et al. 1979; Coastal Environments 1989).

Shipwrecks at Bayou Plaquemine and the Town of Plaquemine

Accounts of shipwrecks frequently give the location as the nearest town. Thus, the wreck of the *Melodeon* sometimes is assigned to Plaquemine rather than a few miles upriver at Dr. Towles' plantation, where Cayton's *Landings* places the wreck (Cayton 1881:33). Numerous serious steamboat accidents are reported for the Plaquemine vicinity. On September 16, 1846, all boilers on the sidewheel wood hull packet *Concordia* exploded; the accident left 28 dead and many wounded (Way 1994:108). On Christmas Eve, 1888, the stern wheel wood hull packet *John H. Hanna* caught fire; 22 people died in the conflagration (Way 1994:252). During the Civil War, a Federal transport, the *Anglo-American*, ran aground at Plaquemine in June 1863. When the Union steamer *Sykes* went to aid the grounded vessels, the townspeople of Plaquemine managed to set both vessels ablaze in a sneak attack. Admiral Farragut, commander of the United States naval forces, was so outraged that he paid a call upon the mayor of Plaquemine to read him a lecture. The mayor insisted that the troublemakers came from out of town and were unknown to the local citizenry. Nevertheless, the U.S.S. *Monongahela* was stationed thereafter at Plaquemine to protect Union vessels from further depredations (Bragg 1977:215).

In addition to the above-mentioned historical sources, two databases provide information relative to the potential for submerged cultural resources within and in the vicinity of the study area. In 1989, Coastal Environments, Inc., at the request of the U.S. Army Corps of Engineers, compiled an inventory of vessels lost on the navigable bodies of water within the New Orleans District (Pearson et al. 1989). Based on previously published wreck lists, historic maps, charts, and other literature, this inventory reported the loss of 17 vessels, ranging in dates from 1833 – 1931, on this section of the Mississippi River. However, all of these vessels, including the steamship *Melodeon*, reportedly were lost downriver from the survey area at Plaquemine Bend (mile 209).

The second database consulted for the Medora Crossing Soft Dike Construction Project survey was the Automated Wreck and Obstruction Information System (AWOIS) of the National Oceanic and Atmospheric Administration (NOAA). Despite the fact that the AWOIS database emphasizes those wrecks that may be hazardous to navigation, no shipwrecks were listed for the area

of 30 degrees, 18' 00" N to 30 degrees, 19'00" N and 91 degrees, 11'00" W to 91 degrees, 11'00" W (Verry, Personal Communication).

Previously Conducted Cultural Resource Inventories

A review of records currently available at the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Archaeology, Baton Rouge, Louisiana, resulted in the identification of 31 previously conducted cultural resources investigations within 5 miles (8 km) of the current project area (Table 1). No previous investigations had been conducted within the current project area.

Previously Recorded Sites within the Current Study Area

A review of the site files and maps located at the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Historic Preservation, Baton Rouge, Louisiana, resulted in the identification of three previously recorded sites located within 1 mile (1.9 km) of the current project area (16IV127, 16IV160, and 16WBR1). All sites identified were located in Iberville Parish, but none were within the project area. The Medora Site (16WBR1) was recorded as a village site incorporating two mounds. The Clara Belle Plantation is representative of the nineteenth century agricultural populations that flourished throughout Louisiana. All of the sites identified were found to be ineligible for listing on the National Register of Historic Places. Details of these sites are presented in Table 2.

Previously Recorded Standing Structures within the Current Study Area

A review of the standing structure files located at the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Historic Preservation, Baton Rouge, Louisiana, resulted in the identification of 12 previously recorded standing structures located within 1 mile (1.9 km) of the current project area (Table 3). All structures identified were located in Iberville Parish, but none were within the project area. None of the structures identified was listed on the National Register of Historic Places.

A total of 12 previously recorded standing structures (24-335 - 24-339, 24-357, 24-358, and 24-360 - 24-364) were identified within 1 mile of the project area. Most of these structures (3-198 - 3-262) were recorded by Tadashi Nakagawa and Dorothy White during 1983. All of these structures were described as residential constructions ranging in date from 1940 - ca. 1930. Structures 24-335 - 24-339 are part of the Bagatelle Plantation and were move in 1977 from St. James Parish. The remainder of the structures appears to have been moved to their present locations when the Morrisonville Levee was constructed. None of the identified structures was assessed for listing on the National Register of Historic Places.

Table 1. Previous Archeological Investigations within 5 miles (8 km) of the Current Project Area

FIELD DATE	REPORT NUMBER	TITLE/AUTHOR	PROJECT DESCRIPTION	RESULTS AND RECOMMENDATIONS
<i>East Baton Rouge Parish</i>				
1977	22-312	Cultural Resource Survey of Proposed Scallan Brothers Borrow Pit 493+00 - 508+00, East Bank, Mississippi River, East Baton Rouge Parish (Gagliano 1977)	Records Review-Pedestrian Survey-Shovel Test	Identified 16EBR46; avoidance recommended
1976	22-352	Archaeological Survey of the Proposed New General Aviation Airport for East Baton Rouge Parish, Louisiana (Louisiana Archaeological Survey and Antiquities Commission 1976)	Records Review-Pedestrian Survey	Identified 16EBR38; no additional work recommended
1977	22-319	Cultural Resource Testing along the Mississippi Riverbank of Woodstock Plantation, East Baton Rouge Parish, Louisiana (Gagliano et al. 1977)	Records Review-Pedestrian Survey-bankline survey, and backhoe excavation	Extensive midden damage due to levee construction prior to testing suggested that the site was not significant; no additional work recommended; samples were retained
1977	22-90	Cultural Resource Survey of the Ponchartrain Levee District Levee Enlargement and Concrete Slope Pavement, Item M-227 to 218-L (Shenkel 1976)	Records Review-Pedestrian Survey-Shovel Test	No significant cultural resources were identified and no additional work recommended
1989	22-1468	A Cultural Resources Survey of Arlington Revetment and LSU Berm Levee Improvement Item, East Baton Rouge Parish, Louisiana (Jones et al. 1993)	Records Review-Pedestrian Survey-Shovel Test-bankline survey, and sedimentation samples	6 occupied structures and 3 sites were identified; 16EBR73 and 16EBR74 were not significant and no additional work was recommended; 16EBR72 was potentially NRHP eligible; the structures apparently were considered non-historic (not clear)
1993	22-1733	An Archaeological Survey of Tract "A" of the J.T. Williams Subdivision in Baton Rouge, Louisiana (McLaughlin 1993)	Records Review-Pedestrian Survey-Shovel Test	No significant cultural resources were identified and no additional work recommended
1997	22-2068	Cultural Resources Survey of the Bayou Fountain Channel Enlargement Area, East Baton Rouge Parish, Louisiana (Wells and Lee 1997)	Records Review-Pedestrian Survey-Shovel Test-Auger Test	No significant cultural resources were identified and no additional work recommended

FIELD DATE	REPORT NUMBER	TITLE/AUTHOR	PROJECT DESCRIPTION	RESULTS AND RECOMMENDATIONS
<i>Iberville Parish</i>				
	22-1352	Cultural Resources Survey of Three Iberville Parish Levee Enlargement and Revetment Construction Items (Goodwin et al. 1993)	Records Review-Pedestrian Survey-Shovel Test-Auger Test-Unit Excavation-backhoe, and bankline survey	Identified 16IV152, 16IV153, 16IV154, 16IV155, SG-5 and SG-6, and reexamined 16IV42; all sites and isolates were not significant, and no additional work was recommended
	22-633	Level I Cultural Resource Survey for Planning Area Number 5, Iberville Parish, Louisiana (McIntire 1980)	Records Review-Level I procedures outlined in Louisiana's Dept. of Culture, Recreation and Tourism cultural resource guidelines. ca. 1980	No cultural resources were identified in project area; no additional testing recommended to satisfy Level I; further testing recommended to satisfy Level II or Level III requirements
	22-752	Cultural Resource Survey for Planning Area Number 2, Iberville Parish, Louisiana (McIntire 1980)	Records Review-Level I procedures outlined in Louisiana's Dept. of Culture, Recreation and Tourism cultural resource guidelines. ca. 1980	No significant cultural resources were identified in project area; no additional testing recommended to satisfy Level I; further testing recommended to satisfy Level II or Level III requirements
	22-853	An Archaeological Survey of the Proposed Plaquemine Bend Revetment (M-204.9 to 201-R), Iberville Parish, Louisiana (Stuart and Greene 1983)	Records Review-Pedestrian Survey-and bankline survey	No significant cultural resources were identified; no additional work recommended; construction should be halted if buried resources are encountered
1974	22-281	White Castle - Plaquemine Highway, Route LA 1 (Rivet 1974)	Records Review-Pedestrian Survey	Identified 5 loci; site inspection recommended at start of construction.
1976	22-621	An Archaeological Survey of the Proposed North Plaquemine Sewerage Facility (Neuman 1976)	Records Review-Pedestrian Survey	No significant cultural resources were identified; notify state if archaeological deposits exposed during sewer installation
1977	22-345	Cultural Resources Survey of Proposed Borrow Pit, Manchac Bend, Mississippi River (Gagliano 1977)	Records Review-Pedestrian Survey-bankline survey	No cultural resources were identified; no additional work recommended
1981	22-762	Level I Cultural Resources Survey and Assessment for the proposed Manchac Oil Refinery, Iberville Parish, Louisiana (Yakubik et al. 1981)	Records Review-Pedestrian Survey-Shovel Test	No significant cultural resources were identified; no additional testing recommended, nearby sites could require Level II investigations should project boundaries change
1983	22-955	An Archaeological Survey of the Proposed St. Gabriel Levee Project (M-206.5 to 198.5-L), Iberville Parish, Louisiana (Shafer et al. 1984)	Records Review-Pedestrian Survey-and bankline survey	One historic site (unnamed) was identified as potentially NRHP eligible and recommended for further testing prior to construction
1997	22-2140	Cultural Resources Investigations at the Proposed Island Golf Community, Iberville Parish, Louisiana (Wells et al. 1988)	Records Review-Pedestrian Survey-Shovel Test	Identified 16IV29, 16IV30, 16IV31, 16IV32, 16IV33, 16IV34, 16IV35; no additional work recommended

FIELD DATE	REPORT NUMBER	TITLE/AUTHOR	PROJECT DESCRIPTION	RESULTS AND RECOMMENDATIONS
<i>West Baton Rouge Parish</i>				
1983	22-852	An Archaeological Survey of the Proposed Missouri Bend Revetment (M-221.1 to 219.4-R), West Baton Rouge Parish, Louisiana (Stuart and Greene 1983)	Records Review-Pedestrian Survey-and bankline survey	No significant cultural resources were identified; no additional work recommended; construction should be halted if buried resources are encountered
1978	22-374	An Archaeological Survey of the Proposed Sewerage System for the Town of Addis (Neitzel 1978)	Records Review-Pedestrian Survey-and vehicular survey	No cultural resources were identified and no additional work recommended
1978	22-385	Cultural Resource Survey of the Proposed Joe Myhand Park at Addis, West Baton Rouge Parish, Louisiana (Perry and Spencer 1978)	Records Review-Pedestrian Survey-Shovel Test	No cultural resources were identified and no additional work recommended
1996	22-2012	Eastern Extent of the Rock Zion Baptist Church Cemetery (16WBR42), Addis, Louisiana (Wells and Doucet 1998)	Ethnography, backhoe monitoring, and mapping	Identified 16WBR42, 5 human graves; avoidance of additional interments or further investigation recommended
<i>Multiple Parishes</i>				
1987	22-1233	Archaeological Atlas and Report of Prehistoric Indian Mounds in Louisiana (Jones and Shuman 1987)	Records review	39 Mound sites were described, but only the Medora Site (16WBR1) lies near the current project area. It was assessed as not significant.
1989	22-1306	Archaeological and Historical Investigations of Four Proposed Revetment Areas Located Along the Mississippi River in Southeast Louisiana (Kelley 1989)	Records Review-Pedestrian Survey-Shovel Test-Auger Test	11 new sites were identified and 2 sites were relocated; 16EBR40, 16EBR56, 16EBR70, and 16EBR71 were located in the Manchac Revetment Item (the only Item within the 5-mile radius of the current project area); no sites in the Manchac Revetment Item were f
1993	22-1660	Underwater Cultural Resources Survey for Contraction Dikes at Red Eye Crossing, Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana (Irion et al. 1993)	Records Review-magnetometer, echosounding, and sonar survey	Identified 68 anomalies in 8 clusters; Cluster D was potentially significant, but will not be affected by current project; the remainder of the anomalies were not significant, and no additional work was recommended
1982	22-733	Cultural Resources Survey of Fourteen Mississippi River Levee and Revetment Items (Iroquois Research Institute 1982)	Records Review-Pedestrian Survey-Shovel Test-Auger Test	Note - this report was missing from the Louisiana SHPO on 11/21/98 and 11/24/98.
1976	22-140	Cultural Resource Survey of Mississippi River Levees, Ponchartrain Levee District, Item M-218L to M-213-L (Shenkel 1976)	Records Review-Pedestrian Survey	Identified IV126, IV127, and EBR40; 16EBR40 only would be impacted; recommendations from SHPO requested.

FIELD DATE	REPORT NUMBER	TITLE/AUTHOR	PROJECT DESCRIPTION	RESULTS AND RECOMMENDATIONS
1982	22-895	Archeological Assessment of Two Sites on the Mississippi River: 16 PC 33 and 16 EBR 46 (Goodwin et al. 1983)	Records Review-Pedestrian Survey-Unit Excavation-and backhoe	Tested 16PC33 and 16EBR46; neither were significant and no additional work was recommended
1989	22-1442	Cultural Resources Survey of Missouri Bend and Plaquemine Revetment Items, West Baton Rouge and Iberville Parishes, Louisiana (Armstrong et al. 1990)	Records Review-Pedestrian Survey-Shovel Test-Auger Test-Unit Excavation	Identified Clara Belle Plantation (16IV160); testing established nonsignificance; no additional work recommended
1989	22-1467	Literature Search and Research Design Amite River and Tributaries Project, Ascension, East Baton Rouge, and Livingston Parishes (Goodwin et al. 1990)	Records Review-Pedestrian Survey-Shovel Test-and boat survey	Re-examined 16AN39 and 16EBR27; identified 3 unconfirmed sites, and recorded 3 sites 16AN50, 16EBR32, and 16LV33; recorded 7 standing structures, and identified 10 additional standing structures of which two were not significant and 8 were unable to be fu
1995	22-1775	Cultural Resources Survey of the Proposed Route of a Liquid Hydrogen Pipeline in Ascension, East Baton Rouge, Iberville, and West Baton Rouge Parishes, Louisiana (Shuman et al. 1995)	Records Review-Pedestrian Survey-Shovel Test-and soil samples	9 sites were identified; 16WBR6, 16EBR72, 16EBR41, and 16AN1 were avoided by reroutes; Locations 1, 2, and 3, and 16AN57 were not significant and no further investigation was recommended, 16AN58 was considered potentially NRHP eligible and monitoring was
1997	22-2161	Cultural Resources Survey of the Proposed Route of a Pipeline in Ascension, East Baton Rouge, Iberville, St. James, and West Baton Rouge Parishes, Louisiana (Jones et al. 1998)	Records Review-Pedestrian Survey-Shovel Test-Unit Excavation	Identified 4 sites; 16AN2, 16IV28, 16SJ49 were not significant, and no additional work was recommended; 16AN1 was NRHP eligible

Table 2. Inventory of Identified Sites in Project Vicinity

SITE NUMBER	UTM COORDINATES	USGS QUADRANGLE	SITE DESCRIPTION	CULTURAL AFFILIATION	FIELD METHODOLOGY	NRHP ELIGIBILITY	RECORDED BY
16IV127	Zone 15 N3354400 E677220	Plaquemine 7.5'	Prehistoric scatter	Coles Creek	Records Review-Pedestrian Survey-Shovel Test-Auger Test	Not Eligible	J. Paige 1983
16IV160	Zone 15 N3355550 E673100	Plaquemine 7.5'	Clara Belle Plantation	19th Century	Records Review-Pedestrian Survey-Shovel Test-Auger Test-Unit Excavation	Not Eligible	Hinks, S. and J. Wojtala 1989
16WBR1	Zone 15 N3356120 E671750	Plaquemine 7.5'	Prehistoric mound; village	Plaquemine		Not Eligible	Jones, D.C. 1987

Table 3. Inventory of Historic Structures in the Project Vicinity

STRUCTURE NO	UTM COORDINATES	QUAD	CONSTRUCTION DATE	TYPE	STYLE	NRHP ELIGIBILITY	RECORDED BY
24-335	Zone 15 N3356280 E674490	Plaquemine 7.5'	1841	Residential	Greek Revival	Not Assessed	White, D (updated by L. Van Horn, n.d.) 1983
24-336	Zone 15 N3356280 E674490	Plaquemine 7.5'	1840s	Residential	Creole	Not Assessed	White, D 1983
24-337	Zone 15 N3356280 E674490	Plaquemine 7.5'	1840	Residential	Creole	Not Assessed	White, D 1983
24-338	Zone 15 N3356280 E674490	Plaquemine 7.5'	1840	Residential	Creole	Not Assessed	White, D 1983
24-357	Zone 15 N3356450 E674410	Plaquemine 7.5'	ca. 1900	Residential	N/A	Not Assessed	White, D and T. Nakagawa 1983
24-358	Zone 15 N3357690 E670520	Plaquemine 7.5'	ca. 1930	Residential	N/A	Not Assessed	White, D and T. Nakagawa 1983
24-339	Zone 15 N3356280 E674490	Plaquemine 7.5'	ca. 1840	Residential	Creole	Not Assessed	White, D and T. Nakagawa 1983
24-360	Zone 15 N3357730 E670910	Plaquemine 7.5'	Unknown	Residential	N/A	Not Assessed	White, D and T. Nakagawa 1983
24-361	Zone 15 N3357720 E670880	Plaquemine 7.5'	Unknown	Residential	N/A	Not Assessed	White, D and T. Nakagawa 1983
24-362	Zone 15 N3357330 E670910	Plaquemine 7.5'	1911	Residential	N/A	Not Assessed	Nakagawa, T. and D. White 1983
24-363	Zone 15 N3357550 E670710	Plaquemine 7.5'	ca. 1900	Residential	N/A	Not Assessed	Nakagawa, T. and D. White 1983
24-364	Zone 15 N3357400 E670850	Plaquemine 7.5'	ca. 1910	Residential	N/A	Not Assessed	Nakagawa, T. and D. White 1983

CHAPTER VII

RESEARCH METHODS

Archival Investigations

Archival research concerning the history of the Medora Crossing Soft Dike Construction Project area focused primarily on two areas: 1) The usage of adjacent land, specifically that of the Medora and Conrad-Towles Plantations, and its relationship to waterborne transportation on this section of the Mississippi River; and 2) The identification of specific vessel losses reported near or within the project area. To accomplish this task, background research was conducted at a number of institutions including the Howard-Tilton Memorial Library at Tulane University, Iberville Parish Courthouse and Iberville Parish Library in Plaquemine, Louisiana, and the Hill Memorial Library at Louisiana State University, Baton Rouge. Additional background information on the project area was obtained through interviews with local historian, Mr. Tony Fama and Historic Preservation Society member Ms. Sue Hebert.

Shipwreck data were obtained through a number of published works including Berman's *Encyclopedia of American Shipwrecks*, *Way's Packet Directory*, and Lytle and Holdcamper's *Merchant Steam Vessels of the United States, 1790-1868*. Supplemental information on area vessel losses was acquired through and the Automated Wreck and Obstruction Information System (AWOIS) of the National Oceanic and Atmospheric Administration (NOAA) and a 1989 inventory prepared for the U.S. Army Corps of Engineers, New Orleans District by Coastal Environments, Inc.

Archeological Investigations

Marine Remote Sensing Survey

The Medora Crossing marine remote sensing survey was conducted from the 26-ft research vessel *Coli*. *Coli* was leased from the Louisiana Universities Marine Consortium (LUMCON), and was captained by LUMCON's Mr. Samuel LeBouef. The survey was conducted along parallel track lines spaced at 50 ft intervals. The project area was approximately 1,800 x 7,016 ft, in size, and consisted of 35 transects with a total length of approximately 46.51 linear miles (Figure 12).

The remote sensing survey was designed to identify specific magnetic or acoustic anomalies and/or clusters of anomalies that might represent potentially significant submerged cultural resources, such as shipwrecks. The natural and anthropogenic forces that form these sites typically scatter ferrous objects such as fasteners, anchors, engine parts, ballast, weaponry, cargo, tools, and miscellaneous related debris across the river bottom. Usually, these objects can be detected with a marine magnetometer, side scan sonar system, and fathometer that record anomalous magnetic or acoustic underwater signatures that stand out against the ambient magnetic or visual field. Two critical elements in the interpretation of such anomalies, which may also derive from natural or modern sources, are their patterns and, in the case of magnetic anomalies, their amplitude and

duration. Because of the importance of anomaly patterning, accurate recording and positioning of anomaly locations is essential.

The equipment array used for the Medora Crossing survey included a DGPS, a proton precession marine magnetometer, a side scan sonar, and a fathometer (Figure 8). Data were collected and correlated via a laptop computer using hydrographic survey software.

Positioning. A Differential Global Positioning System (DGPS) was used to direct navigation and supply accurate positions of magnetic and acoustic anomalies. The DGPS system consisted of a Northstar 941XD with internal DGPS. The Northstar 941XD transmitted position information in NMEA 0183 code to the computer navigation system (version 7.0 of Coastal Oceanographics' *Hypack* software). *Hypack* translates the NMEA message and displays the survey vessel's position on a computer screen relative to the pre-plotted track lines. During post-processing, *Hypack's* positioning files can be utilized to produce track plot maps and to derive the X, Y, and Z values used to produce magnetic and bathymetric contour plot maps. For the Medora Crossing marine remote sensing survey, positioning control points were obtained continuously by *Hypack*, at one-second intervals. During the course of the survey, strong differential signals were acquired with a minimum noise to signal ratio.

Magnetometry. A Geometrics G866 proton precession marine magnetometer was used to complete the magnetic survey. The G866 is a 0.1 gamma sensitivity magnetometer that down loads magnetic data, in digital format, as numeric data files in *Hypack*. As the magnetic data are being collected, *Hypack* attaches the precise real-time DGPS coordinates to each magnetic reading, ensuring precise positioning control. The magnetometer was towed far enough behind the survey vessel to minimize the associated noise, which generally measured less than two gammas. A float was attached to the magnetometer sensor, so that a consistent depth below the water's surface could be maintained. The recording proton precession marine magnetometer is an electronic instrument used to record the strength of the Earth's magnetic field in increments of nanoTeslas or gammas. Magnetometers have proven useful in marine research as detectors of anomalous distortions in the earth's ambient magnetic field, particularly distortions that are caused by concentrations of naturally occurring and manmade, ferrous materials. Distortions or changes as small as 0.5 gammas are detectable when operating the magnetometer at a sampling rate of one second. Magnetic distortions caused by shipwrecks may range in intensity from several gammas to several thousand gammas, depending upon such factors as the mass of ferrous materials present, the distance of the ferrous mass from the sensor, and the orientation of the mass relative to the sensor (Figure 9). The uses of magnetometers in marine archeology and the theoretical aspects of the physical principals behind their operation are summarized and discussed in detail in Aitken (1961), Hall (1966, 1970), Tite (1972), Breiner (1973), Weymouth (1986), and Green (1990).

Individual anomalies produce distinctive magnetic "signatures." These individual signatures may be categorized as: 1) positive monopole; 2) negative monopole; 3) dipolar; or 4)-multi component (Figure 10). Positive and negative anomalies refer to monopolar deflections of the magnetic field and usually indicate a single source. They produce either a positive or negative deflection from the ambient magnetic field, depending on how the object is oriented relative to the magnetometer sensor and whether its positive or negative pole is positioned closest to the sensor. Dipolar signatures display both a rise and a fall above and below the ambient field and they also are commonly associated with single source anomalies, with the dipole usually aligned along the axis of the magnetic field and the negative peak of the anomaly falling nearest the north pole.

Especially important for archeological surveys are multi component anomalies. Multi component or complex signature anomalies consist of both dipolar and monopolar magnetic

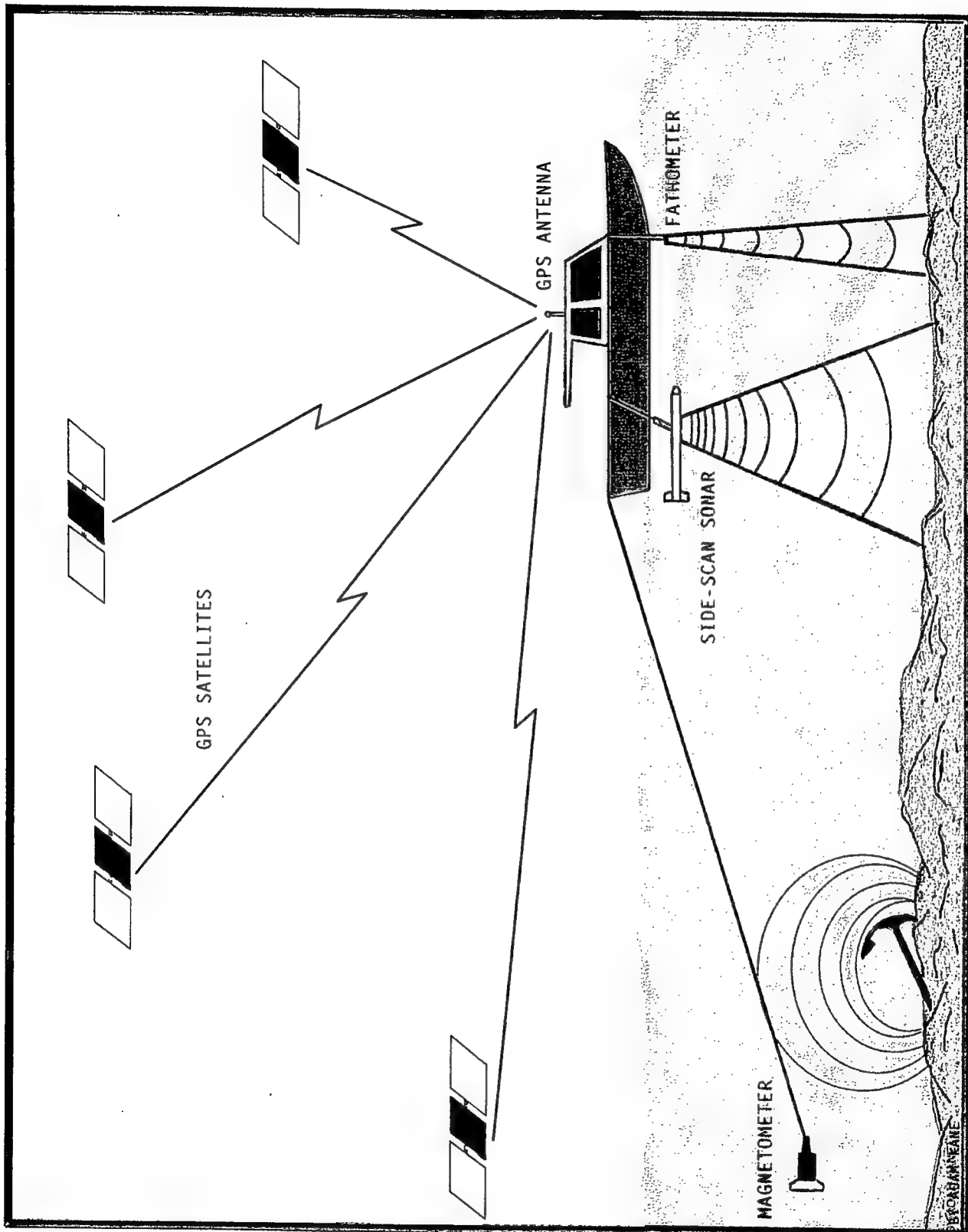


Figure 8. Drawing showing the array of remote sensing and positioning equipment utilized during the Medora Crossing Soft Dike Construction Project survey

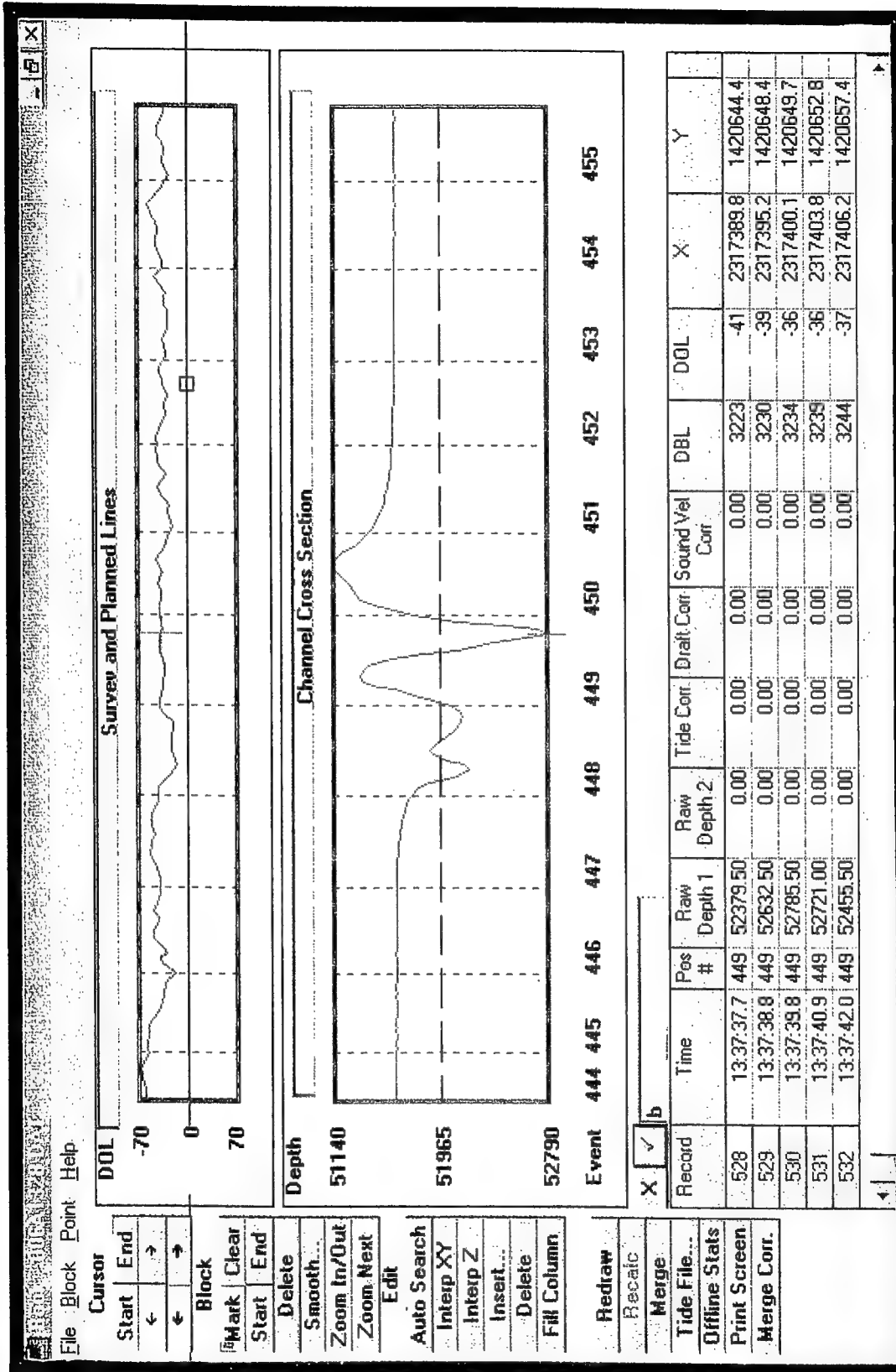


Figure 9. Hypack "Edit" screen image of a 1,650-gamma magnetic anomaly caused by the hull remains of a ca. 1860 steamboat wreck discovered by RCG&A during a recently completed remote sensing survey of the upper Yazoo River, near Greenwood, Mississippi

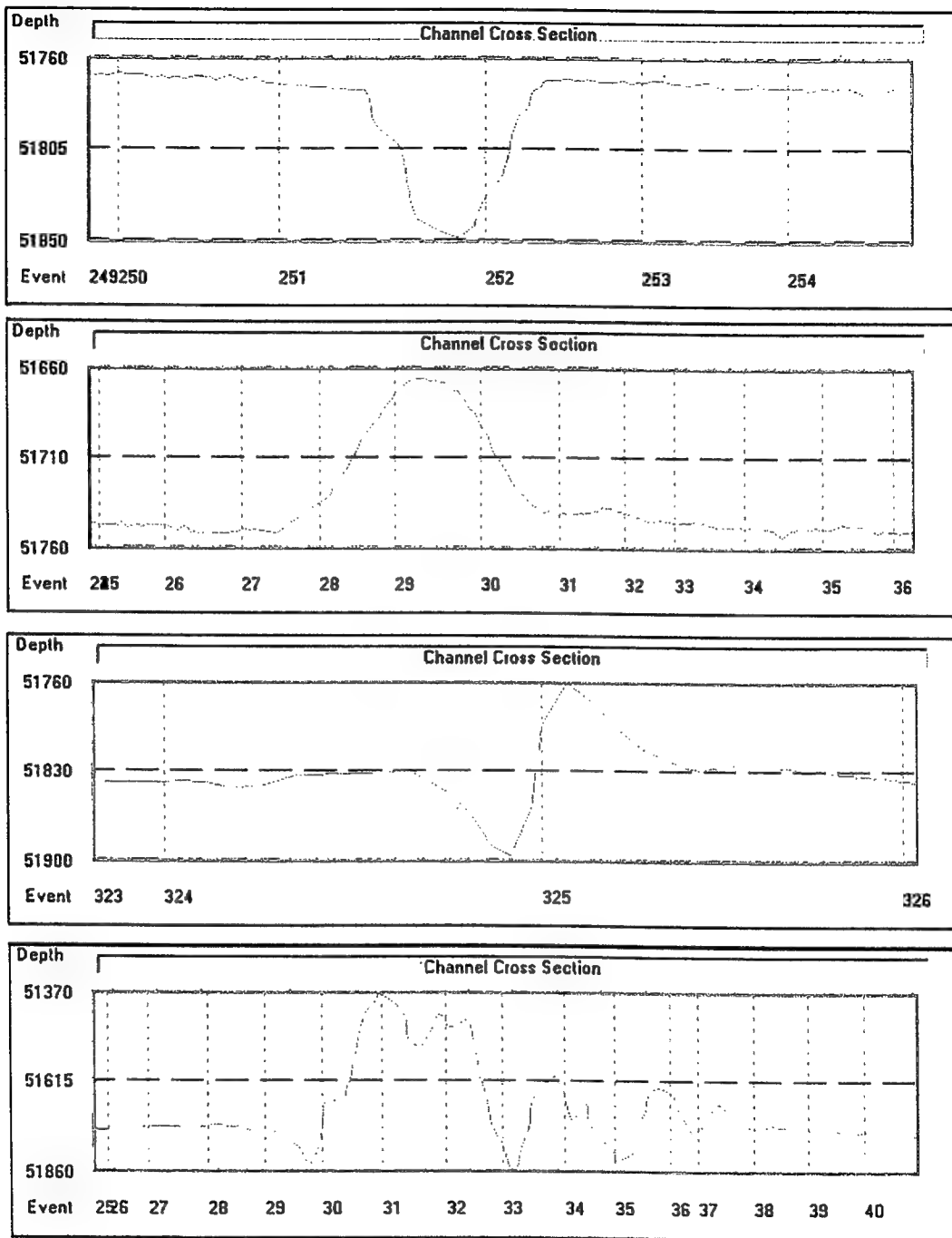


Figure 10. *Hypack* "Edit" screen images illustrating magnetic anomalies with positive monopolar, negative monopolar, dipolar, and ulticomponent signatures. The positive and negative signatures appear inverted because *Hypack* records the magnetic readings as "depths"; therefore, "higher" positive readings appear to trend downward rather than upward

perturbations associated with a large overall deflection that can be indicative of the multiple individual ferrous materials comprising the debris patterns typically associated with shipwrecks. The complexity of the signature is affected partially by the distance of the sensor from the debris and the quantity of debris. If the sensor is close to the wreck, the signature will be multi component; if far away, it may appear as a single source signature.

Acoustic Imaging. Over the course of the past 25 years, the combined use of acoustic (sonar) and magnetic remote sensing equipment has proven to be the most effective method of identifying submerged cultural resources and assessing their potential for further research (Hall 1970; Green 1990). When combined with magnetic data, the near photographic-quality acoustic records produced by side scan sonar systems have left little doubt regarding the identifications of some targets that are intact shipwrecks (Figure 11). For targets lacking structural integrity, or those partially buried beneath bottom sediments, identification can be extremely difficult. Because intact and exposed wrecks are less common than broken and buried wrecks, remote sensing surveys generally produce acoustic targets that require ground-truthing by divers to determine their identification and historic significance.

An Imagenex color imaging digital side scan sonar system was utilized continuously during the Medora Crossing survey to produce sonograms of the river bottom on each transect within the project area. The Imagenex system consisted of a Model 858 processor coupled with a Model 855 dual transducer tow fish operating at a frequency of 330 KHz. The sonar was set at a range of 90 ft per channel, which yielded overlapping coverage of the study areas. Sonar data were recorded in a digital format on a 270 megabyte 3.5 in SyQuest cartridge. A stream of time-tags was attached continuously to the sonar data to assist in post-processing correlation of the acoustic and magnetic data sets. Acoustic images were displayed on a VGA monitor as they were recorded during the survey, and an observation log was maintained by the sonar technician to record descriptions of the anomalies and the times and locations associated with each target. Potential targets were inventoried both during the survey and in post-processing.

The methodology employed during the survey produced favorable results, with reliable DGPS signals, low noise levels on the magnetometer, and clear acoustic images. All positioning and remote sensing equipment performed reliably throughout the survey. Regular and evenly spaced coverage of the entire survey area was achieved.

Survey Control and Correlation of Data Sets. The *Hypack* survey software provided the primary method of control during the survey. Survey lanes were planned in *Hypack*, geodetic parameters were established, and instruments were interfaced and recorded through the computer software. During the survey, the planned survey lines were displayed on the computer screen, and the survey vessel's track was monitored. In addition to providing steering direction for the helmsman, *Hypack* allowed the surveyors to monitor instruments and incoming data through additional windows on the survey screen.

All remote sensing data were correlated with DGPS positioning data and time through *Hypack*. Positions for all data then were corrected through the software for instrument layback and offsets. Positioning was recorded using Louisiana South State Plane grid coordinates, referencing the North American Datum of 1983 (NAD-83). The GRS-1980 ellipsoid was used, along with a Lambert projection.

Remote Sensing Data Analysis

Magnetic and acoustic data were analyzed in the field while they were generated, and post-processed using *Hypack* and Autodesk's *AutoCAD* (Version 12) computer software applications. These computer programs were used to assess the signature, intensity, and duration of individual magnetic disturbances, and to plot their positions within the project area.

In the analysis of magnetometer data for this survey, individual anomalies were identified and carefully examined. First, the profile of each anomaly was characterized in terms of pattern, amplitude, and duration. Magnetic data were correlated with field notes, so that deflections from modern sources, such as channel markers, could be identified. Although all anomalies with an amplitude greater than ten gammas were given a magnetic anomaly number for reference purposes and tabulated (Table 4), anomalies of larger amplitude (more than 50 gammas) and of longer duration (more than 20 seconds) generally are considered to have a higher likelihood of representing possible shipwreck remains, especially when such anomalies cluster together. Side scan sonar data were examined for anomalous acoustic targets and shadows that might represent potentially significant submerged cultural resources (Table 5), and to correlate with any magnetic or bathymetric anomalies.

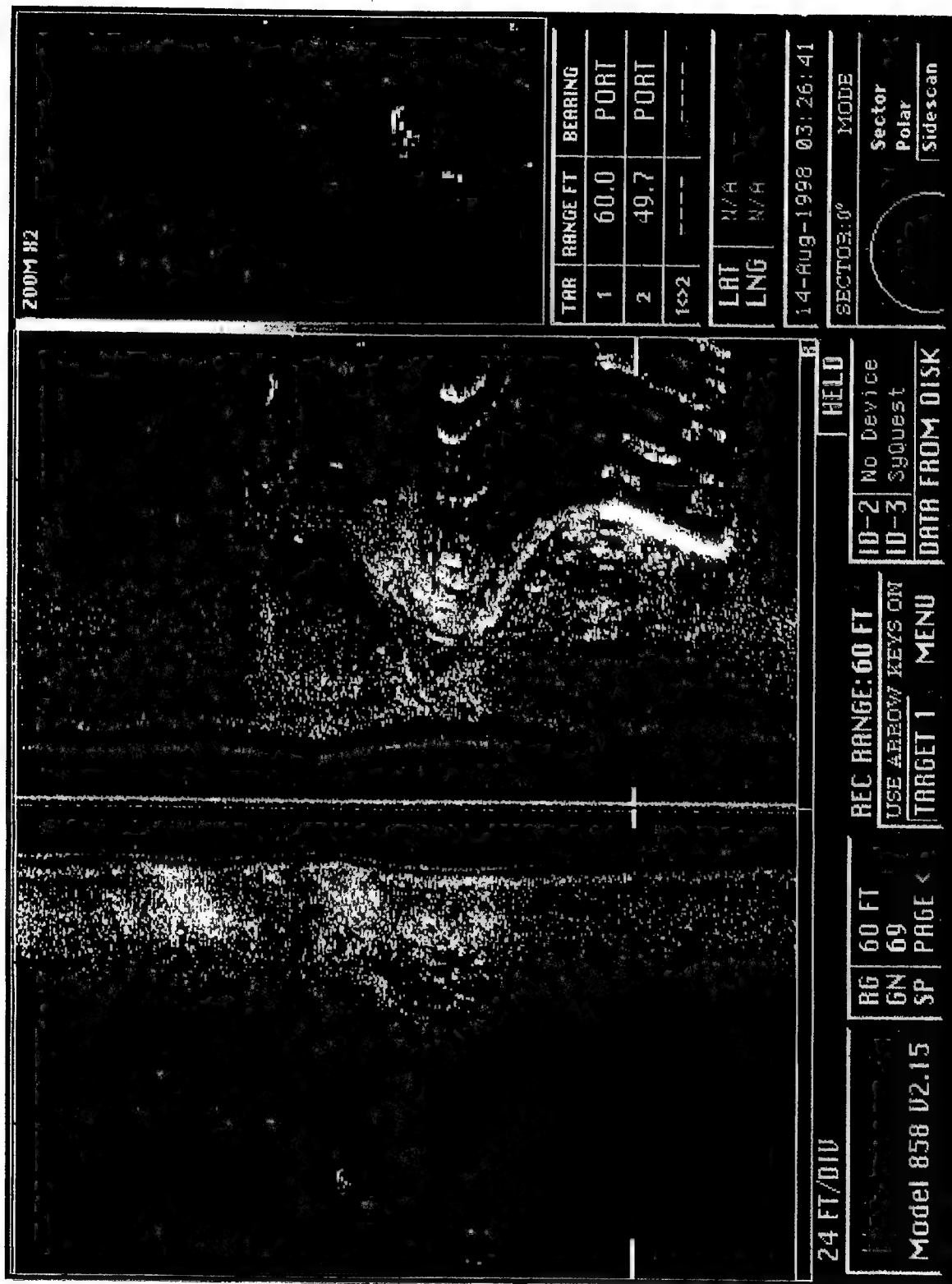


Figure 11. Imagenex 858 side scan image of a submerged ca. 1940's barge discovered by RCG&A during the remote sensing survey of the Washington Sailing Marina on the Potomac River, Alexandria, Virginia

Table 4. Inventory of Magnetic Anomalies Medora Crossing Soft Dike Construction Project Remote Sensing Survey

Run #	Anom #	Duration	Start	End	Signature	Gamma	X	Y	Correlation
1	1	0:00:40	14:55:18	14:55:58	D	11	3326848.1	661281	
	2	0:00:36	14:56:42	14:57:18	+	12.5	3326048	661221.6	
	3	0:00:41	15:04:34	15:05:15	-	48.5	3321727.7	660092.9	
2	4	0:00:45	8:50:20	8:51:05	D	9.5	3326961.1	661230.9	
	5	0:00:36	8:52:02	8:52:38	+	11.5	3326065.2	661178.4	
	6	0:01:01	9:00:40	9:01:41	D	20.5	3321905.2	660154.8	
3	7	0:01:14	9:38:29	9:39:43	+	4.5	3327149.7	661154	
	8	0:01:10	9:40:40	9:41:50	D	6.5	3326119.1	661126.3	
	9	0:00:40	9:47:36	9:48:16	+	16	3322835.5	660518.3	
4	10	0:01:10	9:49:36	9:50:46	D	5.5	3321950.9	660092.6	
	11	0:00:53	10:38:54	10:39:47	+	60	3322857.2	660486.2	
	12	0:00:25	11:14:05	11:14:30	+	7	3326515.7	661052.5	
5	13	0:00:22	11:22:02	11:22:24	D	21.5	3322831.5	660398.9	
	14	0:00:26	11:14:03	11:14:29	D	7	3326422.8	661040.2	
	15	0:00:22	11:22:02	11:22:24	D	22	3322884.4	660410.3	
6	16	0:00:41	11:59:25	12:00:06	D	6.5	3327094.5	661010.3	
	17	0:00:24	12:00:32	12:00:56	+	4.5	3326382.7	661026	
	18	0:00:46	12:06:45	12:07:31	D	10	3323493.5	660516.4	
7	19	0:00:33	12:08:11	12:08:44	-	11	3322746.6	660306.4	
	20	0:00:13	12:10:44	12:10:57	-	10	3321790.5	659852.9	
	21	0:00:27	12:41:47	12:42:14	+	5.5	3327113.5	660975	
8	22	0:00:21	12:52:34	12:52:55	+	6.5	3322762.5	660282	
	23	0:00:55	12:55:23	12:56:18	D	24	3321843.1	659844.9	
	24	0:00:32	13:28:05	13:28:37	-	5.5	3325691.9	660836.5	
9	25	0:00:28	13:38:41	13:39:09	+	6.5	3321816.5	659755.5	
	26	0:00:25	13:39:22	13:39:47	D	49.5	3321668.5	659677.9	
	27	0:00:08	15:11:38	15:11:46	-	11	3321430.3	659487.5	
28	28	0:00:10	15:12:15	15:12:25	+	9	3321621.9	659610.7	
	29	0:00:31	15:12:35	15:13:06	D	64.5	3321788.4	659649.1	
	30	0:01:08	15:24:02	15:25:10	-	25	3325491.6	660776.6	

Run #	Anom #	Duration	Start	End	Signature	Gamma	X	Y	Correlation
10	31	0:01:25	15:30:43	15:32:08	D	25.5	3325260.3	660715	
	32	0:00:32	15:39:11	15:39:43	D	18.5	3321616.4	659564.9	
	33	0:01:31	15:43:38	15:45:09	D	24.5	3325090.8	660655.6	
11	34	0:00:36	14:04:28	14:05:04	M	83	3322927.4	659966.5	
12	35	0:01:07	13:27:32	13:28:39	+	10	3324853.2	660511.7	
13	36	0:00:21	13:31:17	13:31:38	-	39.5	3323168.6	660076.7	
	37	0:00:33	13:31:46	13:32:19	M	49.5	3322955.9	660013.6	
	38	0:00:10	13:33:48	13:33:58	-	57.5	3322094.8	659623.2	
14	39	0:00:51	12:52:25	12:53:16	D	7	3327170.3	660612.6	
	40	0:00:42	12:57:08	12:57:50	+	8.5	3324581.5	660377.8	
	41	0:00:35	12:59:22	12:59:57	-	17.5	3323740	660160.2	
15	42	0:00:31	13:01:05	13:01:36	D	39.5	3322937.3	659960.8	
	43	0:00:38	12:27:29	12:28:07	-	37.5	3323740.9	660108.5	
	44	0:00:17	12:29:22	12:29:39	+	47.5	3322966.2	659911.5	
16	45	0:00:34	11:47:20	11:47:54	-	6.5	3327107.4	660491.9	
	46	0:01:28	11:53:16	11:54:44	D	34.5	3323796.7	660068.7	
	47	0:00:31	11:56:01	11:56:32	+	51	3323054.4	659900.1	
17	48	0:00:21	11:57:46	11:58:07	-	21	3322315.6	659534.7	
	49	0:00:26	11:08:48	11:09:14	+	8.5	3324661.3	660240.8	
	50	0:00:45	11:10:32	11:11:17	-	35.5	3323801.5	660016.7	
18	51	0:00:36	11:12:26	11:13:02	+	10	3322975.3	659819.3	
	52	0:00:19	11:15:14	11:15:33	+	9	3322065.8	659372.6	
	53	0:00:29	10:08:32	10:09:01	+	8.5	3324646.4	660191.1	
19	54	0:00:25	10:09:06	10:09:31	+	7.5	3324412.8	660115.1	
	55	0:01:19	10:09:33	10:10:52	D	41	3323992.8	660015.6	
	56	0:00:10	9:27:23	9:27:33	-	13	3322120.1	659293.9	
20	57	0:00:12	9:29:30	9:29:42	D	12	3322613.9	659505.4	
	58	0:00:00	9:36:53	9:36:53	-	75.5	3324407.1	660028.2	
	59	0:00:05	9:09:05	9:09:10	+	14	3327468.8	660317.1	
21	60	0:01:11	9:14:54	9:16:05	-	56.5	3324493.9	660037.7	
	61	0:07:05	16:40:08	16:47:13	D	38	3324699.5	660000.5	
	62	0:02:20	16:57:45	17:00:05	D	38.5	3326647	660312.4	
22	63	0:01:04	17:04:49	17:05:53	-	4	3327695.4	660262.9	
	64	0:00:28	16:04:34	16:05:02	-	6	3327672	660209.3	

Run #	Anom #	Duration	Start	End	Signature	Gamma	X	Y	Correlation
23	65	0:02:02	16:09:36	16:11:38	D	30	3324495.4	659915.4	
	66	0:00:17	15:22:13	15:22:30	D	96.5	3321805.8	658905.5	
	67	0:00:23	15:27:16	15:27:39	+	8.5	3322816.3	659400.8	
	68	0:06:01	15:36:54	15:42:55	M	10.5	3325030.8	659990.6	
24	69	0:02:02	15:57:24	15:59:26	-	9	3327729.3	660147.7	
	70	0:00:54	15:05:30	15:06:24	-	9	3327712.7	660102	
	71	0:00:16	15:13:58	15:14:14	-	7	3323691.5	659620	
	72	0:00:08	15:15:06	15:15:14	D	23	3323222	659494.6	
25	73	0:00:15	14:32:00	14:32:15	+	7	3323436.5	659532.7	
	74	0:01:23	14:47:06	14:48:29	D	10.5	3326296.1	660062.3	
	75	0:00:52	14:06:28	14:07:20	-	4.5	3327702.3	660022.6	
	76	0:00:17	14:10:02	14:10:19	+	7.5	3325982.1	65954.8	
27	77	0:00:21	14:12:23	14:12:44	D	8	3324803.2	659807.5	
	78	0:00:22	13:32:14	13:32:36	D	13.5	3325973.1	659910.7	
	79	0:00:08	13:36:18	13:36:26	+	14.5	3323853.3	659519.3	
	80	0:00:19	13:37:47	13:38:06	+	8.5	3322991.9	659289.8	
28	81	0:00:31	16:13:24	16:13:55	D	6.5	3327405	659913.2	
	82	0:00:09	16:17:20	16:17:29	+	36.5	3325573.6	659805.6	
	83	0:00:18	16:19:21	16:19:39	D	19.5	3324602.1	659649.9	
	84	0:00:09	16:22:35	16:22:44	+	35.5	3323185.9	659283.9	
29	85	0:00:16	16:24:44	16:25:00	D	111	3322264.5	658878.4	
	86	0:00:27	12:56:39	12:57:06	D	42	3321960	658622.7	
	87	0:00:23	12:58:09	12:58:32	D	40	3322194.4	658764.6	
	88	0:00:27	13:05:56	13:06:23	-	164.5	3323868.8	659437.6	
30	89	0:00:20	13:11:49	13:12:09	+	17.5	3325294.7	659767	
	90	0:02:08	13:17:24	13:19:32	-	88	3326746.8	659857.4	
	91	0:00:13	12:45:34	12:45:47	D	30	3324321.7	659473.7	
	92	0:00:16	12:46:26	12:46:42	+	13.5	3323869.2	659342.8	
31	93	0:00:07	12:47:15	12:47:22	+	32	3323513.7	659287.7	
	94	0:00:16	16:31:02	16:31:18	-	41	3323720.3	659253.8	
	95	0:00:10	16:32:15	16:32:25	D	54.5	3323139.6	659101.1	
	96	0:00:28	12:11:07	12:11:35	D	61	3321944.6	658506.2	
32	97	0:00:18	12:19:47	12:20:05	+	76.5	3323844.7	659278.5	
	98	0:00:20	12:23:03	12:23:23	D	24	3324721.9	659462.9	

Run #	Anom #	Duration	Start	End	Signature	Gamma	X	Y	Correlation
33	99	0:00:49	12:30:48	12:31:37	+	46	3326831.8	659741.1	
	100	0:00:51	12:32:26	12:33:17	D	29.5	3327242	659734.5	
	101	0:00:21	12:33:56	12:34:17	D	13.5	3327545.7	659711.8	
	102	0:00:19	12:35:17	12:35:36	-	7.5	3327893.2	659713.5	
	103	0:00:08	14:27:04	14:27:12	+	24	3322197.3	658557.4	
34	104	0:00:16	14:37:03	14:37:19	D	27	3325872.2	659615.8	
	105	0:00:17	14:38:11	14:38:28	D	13	3326376.5	659655.2	
	106	0:00:28	14:39:17	14:39:45	D	52.5	3326886.5	659657	
	107	0:00:11	15:51:09	15:51:20	-	14	3322145.7	658474.9	
	108	0:00:23	15:55:33	15:55:56	M	32	3323502.2	659061.6	
35	109	0:00:21	15:57:16	15:57:37	D	62	3324104.5	659236.4	
	110	0:00:15	16:03:48	16:04:03	-	251	3326487.6	659607.6	
	111	0:00:33	16:04:46	16:05:19	-	26	3326962.8	659650.5	
	112	0:00:29	16:06:43	16:07:12	D	36.5	3327697.7	659610.1	
	113	0:00:18	15:35:44	15:36:02	-	30.5	3327189.3	659558.9	
35	114	0:00:21	15:39:06	15:39:27	+	505	3325810	659497.5	
	115	0:00:11	15:41:04	15:41:15	+	137.5	3324939	659373.6	
	116	0:00:11	15:44:22	15:44:33	D	188	3323328.4	658971.7	
	117	0:00:07	15:45:00	15:45:07	+	110	3323078.6	658846.8	

Table 5. Inventory of Acoustic Anomalies from the Medora Crossing Soft Dike Construction Project Remote Sensing Survey

Anomaly #	Line	Time	Disk #/%	Offset	Description	Correlation	X	Y
A1	35	15:35:44 to 12:35:58	1/8%	120.7-134.8 ft. port	narrow, linear anomaly casting slight shadow		3327232.9	659572
A2	35	15:36:48 to 12:38:03	1/8%	118.9-126.0 ft. port	segmented, narrow, linear anomaly casting slight shadow		3326586.8	659539.6
A3	35	15:36:54 to 12:37:25	1/9%	56.8-109.0 ft. port	very narrow, linear anomaly with faint shadow		3326706.6	659587.2
A4	35	15:38:12 to 12:38:37	1/9%	118.3-123.0 ft. port	narrow, linear anomaly casting slight shadow		3326179.6	659534.6
A5	35	15:38:12 to 12:38:34	1/9%	83.2-84.9 ft. port	narrow, linear anomaly casting slight shadow		3326203	659532.9
A6	35	15:38:25 to 12:38:38	1/9%	55.6-66.7 ft. port	narrow, linear anomaly casting slight shadow		3326134.2	659537.6
A7	33	14:25:29 to 14:25:45	1/26	116.0-129.5 ft. port	anomaly composed of parallel, linear segments approx. 12'x75'		3321774.9	658438.1
A8	33	14:29:02 to 14:29:13	1/28	24.5-43.3 ft. port	narrow, linear anomaly casting slight shadow		3322817.8	658861.4
A9	31	16:22:07 to 16:22:21	1/61	87.4-100.9 ft. port	narrow, linear anomaly casting slight shadow		3327935.3	659787.5
A10	31	16:22:57 to 16:24:28	1/62	80.3-116.7 ft. sbd.	segmented, narrow, linear anomaly casting slight shadow		3327183	659783.5
A11	31	16:23:52 to 16:24:02	1/62	78.6-97.3 ft. sbd.	narrow, linear anomaly casting slight shadow		332707502	659767.7
A12	31	16:24:08 to 16:24:24	1/62	119.6-130.8 ft. sbd.	narrow, linear anomaly casting slight shadow		3326926.3	659767.9
A13	32	12:25:28 to 12:25:33	2/9%	107.3 ft sbd	small linear feature approximate 2.0 x 21 ft.		3325293.2	659622.7
A14	30	12:47:17 to 12:47:27	2/17	94.3 ft port	3 narrow linear objects 1.8 ft wide spaced 9 ft apart 70+ ft long		3323497.1	659282.9
A15	29	12:59:29 to 12:59:37	2/20	80.0 ft sbd	5 linear features 67 ft long spaced 2.9 ft wide, across a 40 ft area.		3322425.5	658892.7
A16	29	13:01:05 to 13:01:14	2/21	56.3 ft sbd	single feature 4.7 ft x 10 ft high. ft by 3.3 ft		3322741.4	659049.5
A17	29	13:13:41 to 13:14:06	2/26	75.5 ft port	single linear feature with 3 to 4 ft height above bottom		3325734.7	659792.5
A18	26	14:10:13 to 14:10:40	2/38	124 ft sbd	area of small multiple anomalies, with low relief		3325885.4	659962.1
A19	26	14:11:51 to 14:12:14	2/39	115 ft sbd	area of small multiple anomalies, with low relief		3325092.7	659898
A20	21	16:20:46 to 16:20:54	2/84	124.8-134.8 ft. port	anomaly composed of parallel, linear segments approx. 10'x20'		3321676.7	658968.8
A21	21	16:32:49 to 16:32:52	2/88	38.6-41.5 ft. port	narrow, linear anomaly casting slight shadow		3323360.4	659738.7
A22	21	16:36:08 to 16:36:26	2/89	109.5-123.6 ft. port	anomaly composed of parallel, linear segments approx. 14'x45'		3323803.6	659849.8
A23	16	11:59:40 to 11:59:43	3/36	16.4-29.3 ft. sbd.	small, segmented anomaly approx. 13' casting separate shadows		3321633.1	659236.1
A24	3	9:43:07 to 9:43:08	3/76	114.8 ft. port	very small, circular anomaly casting shadow		3325172.2	661064.5

CHAPTER VIII

SURVEY RESULTS

The following discussion presents the results from the Phase I archeological Study for the Medora Crossing Soft Dike Construction Project. The general overview is followed by a description of the anomalies located in the survey area. Figure 12 shows the spatial distribution of the magnetic anomalies. As noted above, these anomalies were identified initially by reading individual trackline data sets, rather than by contouring; however, contours were produced and analyzed for those targets that will be impacted by the dike construction project.

General Overview of the Survey Results

A total of 117 individual magnetic anomalies were detected during the Medora Crossing survey (Table 4). The magnetic anomalies were grouped into a total of 17 "targets." As noted above, some of these targets fell within the survey block, but will not be impacted by the proposed soft dike project.

A total of 24 acoustic anomalies were recorded within the project area, none of which had corresponding magnetic data; these are described in Table 5. All 24 acoustic anomalies appeared to represent either natural debris, such as submerged trees and logs, or modern man-made debris that has washed into the river, fallen off vessels, or been discarded. For this reason, only three acoustic anomalies are plotted on Figure 12. These acoustic anomalies (A7, A20, and A22) appear as parallel, linear segments ranging in size from 10-14 ft wide x 20-80 ft long, and are probably corrugated cargo covers from transiting barges or sections of riverbank stabilization mats (Figure 13).

The following discussion describes 17 magnetic clusters or targets. An assessment of each target's potential for representing a significant submerged cultural resource is presented, and management recommendations for these resources are provided. Individual magnetic anomalies are quantified in Table 4. In considering these anomalies, water depth, lane spacing, magnetic deflection, duration of deflection, and proximity to observed manmade structures all were taken into account.

Target #1. Target #1 consisted of three magnetic anomalies, M32, M26, and M28. M32 (18.5 gamma, 32.0 seconds) and M26 (49.5 gamma, 25.0 seconds) were considered low amplitude, dipolar magnetic disturbances of long (M32) and medium duration (M26); magnetic anomaly M28, also of medium duration (9.0 gamma, 10.0 seconds), was a low amplitude monopolar disturbance.

TABLE 6. X AND Y COORDINATES FOR MAGNETIC ANOMALIES IN TARGET 1

Anom #	Line	X (NAD 83)	Y (NAD 83)	Correlation
M32	10	3321616.4	659564.9	
M26	8	3321668.5	659677.9	
M28	9	3321621.9	659610.7	

The magnetic signatures of this cluster indicate a possible object or objects that are buried beneath more than 20 ft of sediment. However, the magnetic contour study of Target #1 (Figure 14) indicates that this anomaly represents isolated ferrous material. Based upon this information, we conclude that this target does not represent a significant submerged cultural resource, and no further work is recommended.

Target #2. Target #2 comprises four magnetic disturbances: M25, M20, M29 and M23. Anomalies M25 (6.5 gamma, 28.0 seconds) and M20 (10.0 gamma, 13.0 seconds) are both considered low amplitude, monopolar disturbances of medium duration. M29 is a medium amplitude (64.5 gamma) perturbation of long duration (31.0 seconds) that exhibits a dipolar signature. M23 (24.0 gamma) is a low amplitude, dipolar disturbance of long duration (55.0 seconds). The magnetic signals of Target #2 indicate the presence of a complex anomaly buried beneath the sediment. This target may represent a potentially significant cultural resource. However, Target # 2 lies outside of the proposed borrow area and will not be impacted by the soft dike construction. Therefore, no further work is warranted for this project.

Target #3. Target #3 consists of a pair of very long duration, low amplitude, dipolar magnetic disturbances, M6 (61.0 seconds, 20.5 gamma) and M10 (70.0 seconds, 5.5 gamma). Together, the long duration of M6 and M10, the shallow water depth (approximately 10 ft), and the low-amplitude, dipolar signatures indicate a deeply buried ferrous mass that is not characteristic of a submerged vessel. No correlative acoustic data were recorded for this target. Target #3 also is located a considerable distance from the construction impact area. For these reasons, no further study of this target area is warranted or recommended.

Target #4. Target #4 includes a series of six magnetic anomalies: M51, M47, M44, M42, M34, and M37. M51 is a low amplitude (10.0 gamma), monopolar disturbance of long duration (36.0 seconds). M47 is a medium amplitude (51.0 gamma), long duration (31.0 seconds) monopolar disturbance. Magnetic anomaly M44 is a low amplitude (47.5 gamma), monopolar disturbance of medium duration (17 seconds). M42 is a low amplitude (39.5 gamma), dipolar perturbation of long duration (31.0 seconds). M34 is a medium amplitude, multicomponent magnetic disturbance of long duration (36.0 seconds). M37 is a low amplitude (49.5 gamma), long duration (33.0 seconds), magnetic disturbance also exhibiting a multicomponent signature.

The magnetic characteristics of Target #4 indicate a very complex anomaly grouping. However, the spatial proximity of Target #4 to a current navigational buoy and the absence of corresponding acoustic data suggest that these anomalies are associated with the remaining ground tackle of earlier navigational aids that were lost to flood waters or vessel traffic. Target #4 lies outside of the proposed dike construction and dredge area. Therefore, no further study of this target is warranted or recommended.

Target #5. Target #5 consists of a pair of low amplitude, monopolar magnetic anomalies: M22 (6.5 gamma) and M19 (and 11.0 gamma). While M22 is considered a disturbance of medium duration (21.0 seconds), M19 is categorized as long (33.0 seconds). The low amplitude and monopolar signatures of these anomalies are not characteristic of submerged cultural resources. Additionally, Target #5 has no correlative acoustic data. The target also is located outside the project's impact area. For these reasons, no further study of this target area is warranted or recommended.

Target #6. Target #6 comprises a series of magnetic perturbations: M9, M11, M13, M15, M19, and M22. Anomaly M9 is a low amplitude (16.0 gamma), monopolar disturbance of long duration (40.0 seconds). Anomaly M11 is a medium amplitude (60.0 gamma), monopolar

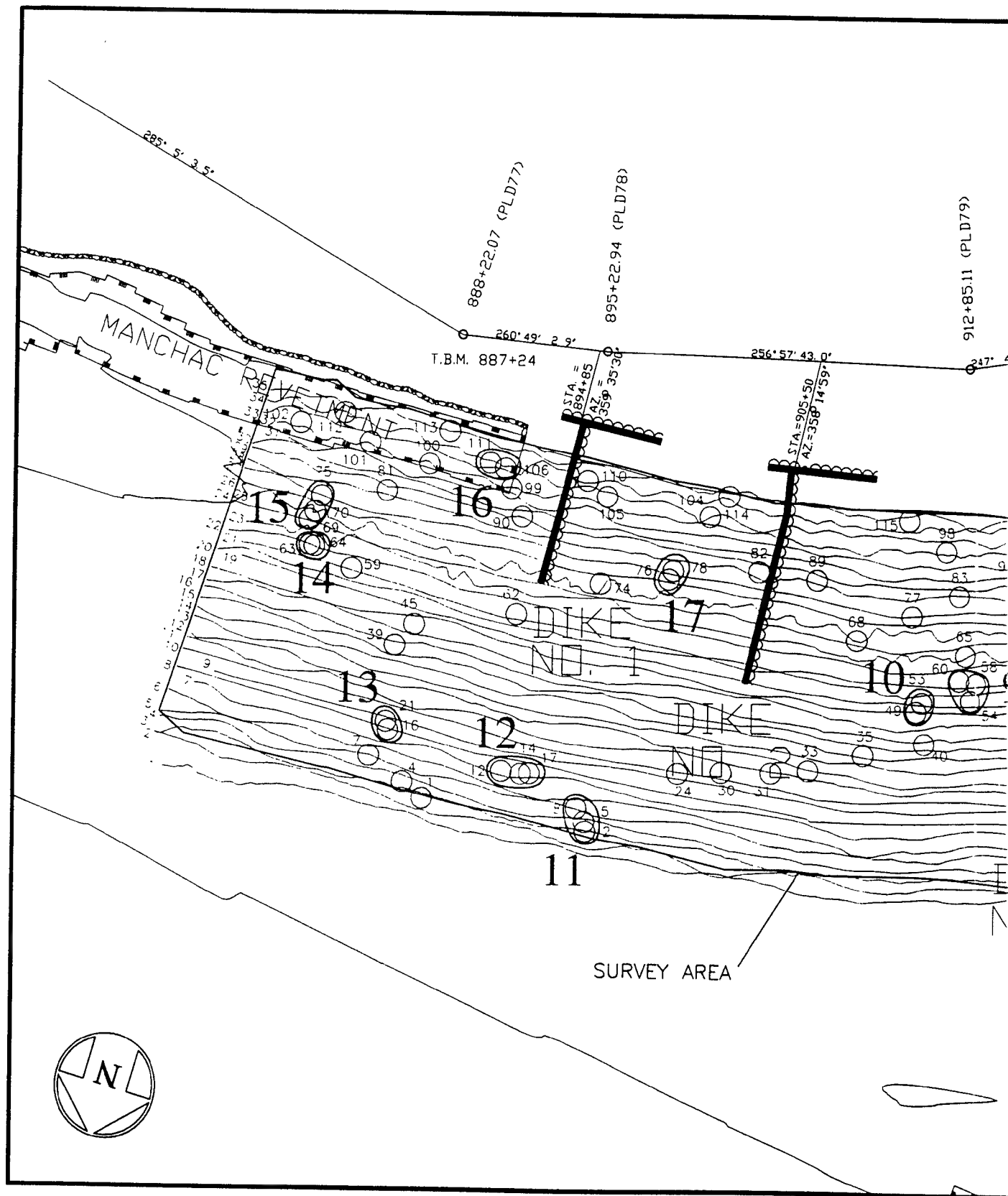
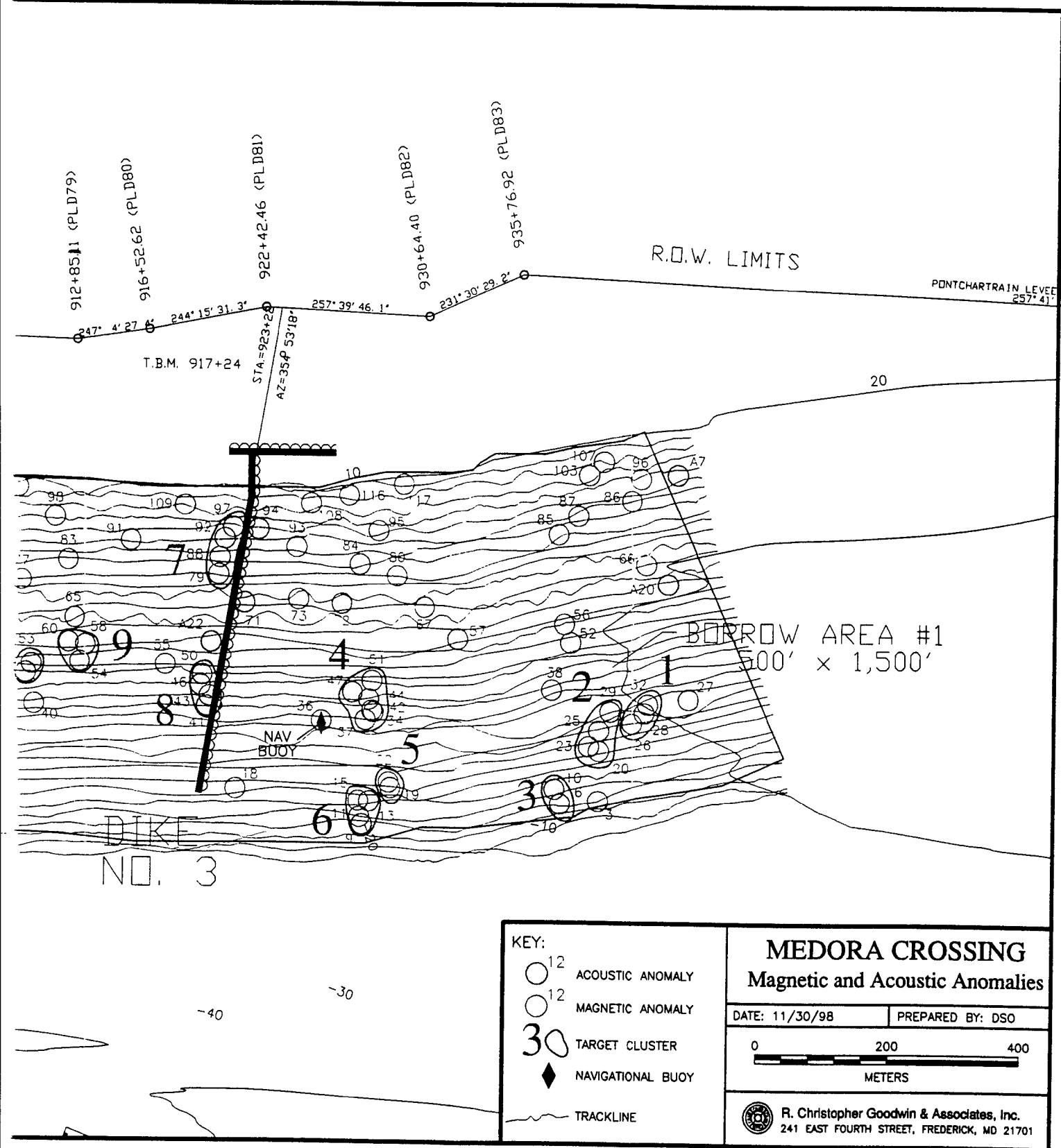


Figure 12. Medora Crossing survey area with vessel tracklines, magnetic anomalies and select acoustic anomalies



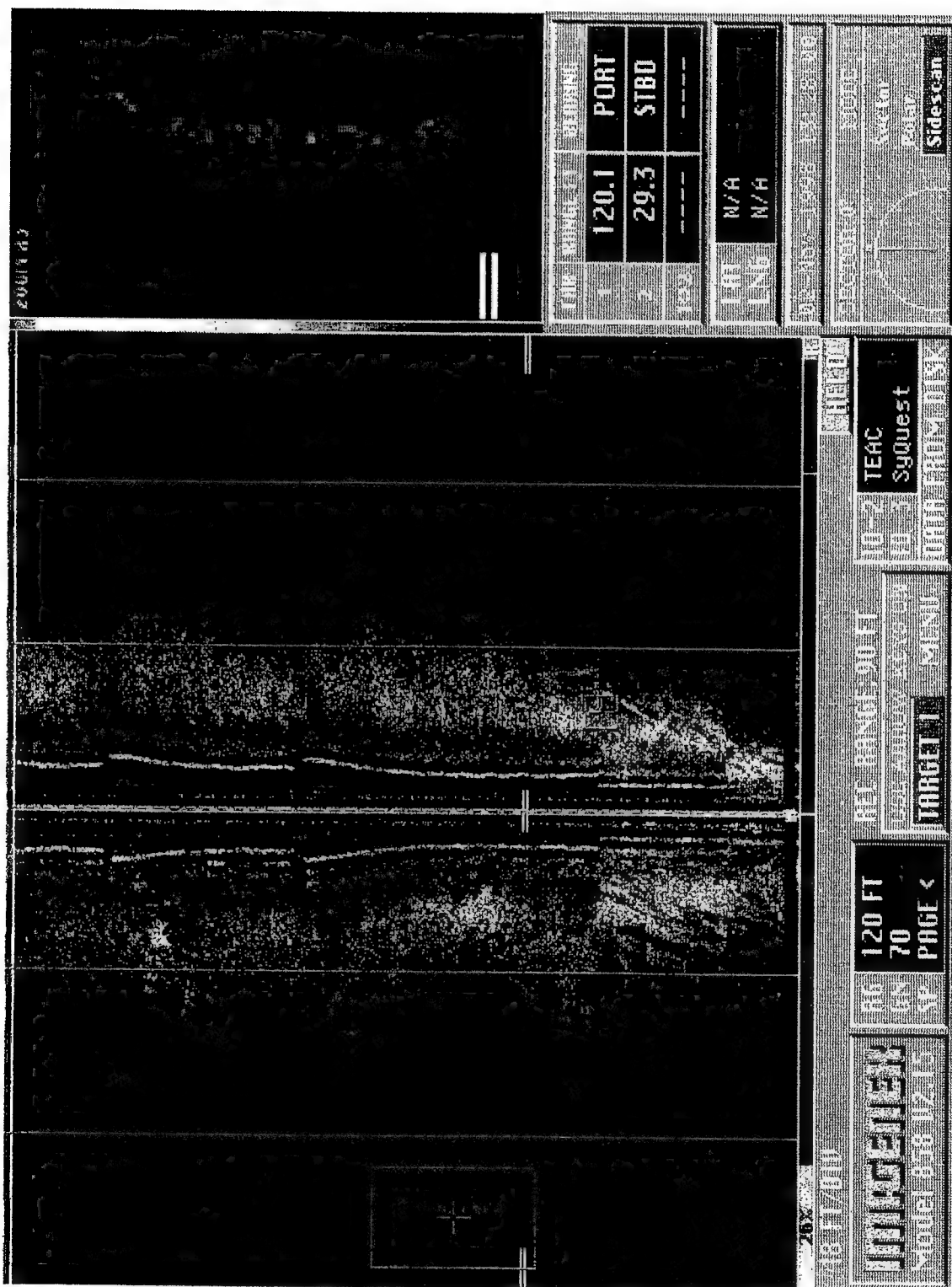


Figure 13. Imagenex 858 side scan sonar image of possible barge cargo for revetment mats

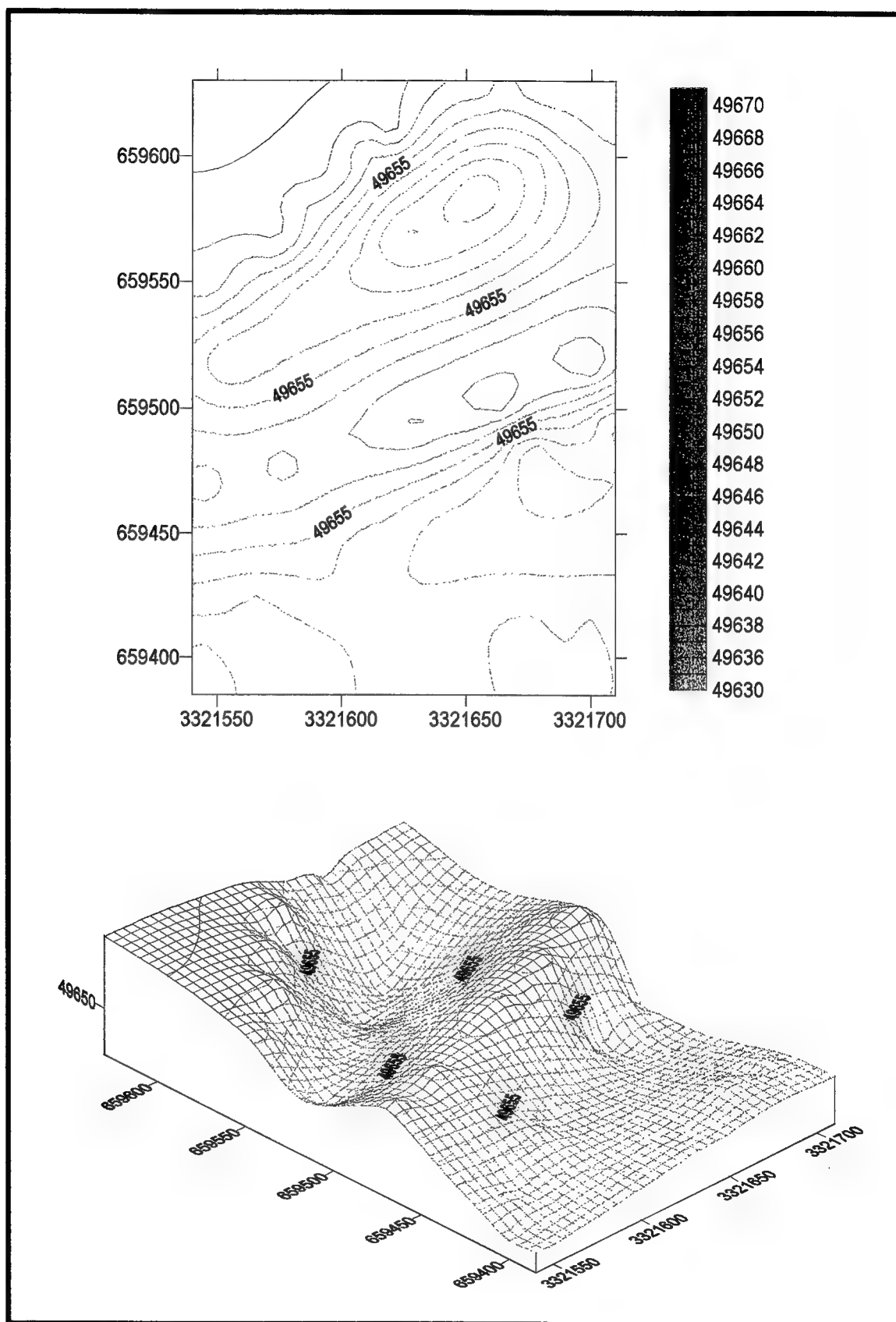


Figure 14. Magnetic contouring of Target #1

disturbance of long duration (53.0 seconds). M13 is a dipolar magnetic perturbation of low amplitude (21.5 gamma) and medium duration (22.0 seconds). M15 (22.0 gamma) is also a dipolar disturbance of low amplitude and medium duration (22.0 seconds). M19 is a low amplitude (11.0 gamma), monopolar disturbance of long duration (33.0 seconds). M22 is considered of low amplitude (6.5 gamma), medium duration (21.0 seconds) and exhibits a monopolar signature.

Target #6 is a complex anomaly that consists of six individual magnetic anomalies; however, the low amplitudes, monopolar and dipolar signatures, and relatively short durations of these perturbations do not indicate the presence of a submerged cultural resource. Target #6 also lies outside of the project impact area. Therefore, no further study of this target is warranted or recommended.

Target #7. Target #7 (Table 7) includes four monopolar magnetic disturbances: M79, M88, M92, and M97. M79 is a low amplitude disturbance (14.5 gamma) of 8.0 seconds, categorizing it as short duration. M88 is a high amplitude (164.5 gamma), medium duration (27.0 seconds) perturbation. M92 is a low amplitude (13.5 gamma) magnetic perturbation of medium duration (16.0 seconds). M97 (76.5 gamma) is considered a perturbation of medium amplitude and duration (18.0 seconds).

TABLE 7. X AND Y COORDINATES FOR MAGNETIC ANOMALIES IN TARGET 7				
Anom #	Line	X (NAD 83)	Y (NAD 83)	Correlation
M79	27	3323853.3	659519.3	
M88	29	3323868.8	659437.6	
M92	30	3323869.2	659342.8	
M97	32	3323844.7	659278.5	

Despite the high amplitude of M88 (164.5 gamma), the monopolar signatures of the magnetic anomalies comprising Target #7 and the absence of correlative acoustic data do not indicate the presence of a shipwreck or other significant submerged cultural resource. Further, magnetic contour studies (Figure 15), and pattern analysis indicate that these anomalies are isolated ferrous material. Therefore, no additional study of this target area is recommended.

Target #8. Target #8 comprises a set of four magnetic (M50, M46, M43 and M41) perturbations. M50 (35.5 gamma) is considered a low amplitude, monopolar disturbance of long (45.0 seconds) duration. M46 (34.5 gamma) is categorized as a low amplitude, dipolar disturbance of long duration (1 minute, 28.0 seconds). M43 (37.5 gamma) is a low amplitude, monopolar perturbation of long duration (38.0 seconds). Magnetic anomaly M41 (17.5 gamma) is a low amplitude, long duration (35.0 seconds) disturbance exhibiting a monopolar signature.

TABLE 8. X AND Y COORDINATES FOR MAGNETIC ANOMALIES IN TARGET 8				
Anom #	Line	X (NAD 83)	Y (NAD 83)	Correlation
M50	17	3323801.5	660016.7	
M46	16	3323796.7	660068.7	
M43	15	3323740.9	660108.5	
M41	14	3323740	660160.2	

The magnetic characteristics of M50, M46, M43 and M41, specifically the low amplitude levels and predominance of monopolar signatures, do not support the presence of a significant submerged cultural resource. Additionally, the magnetic contour study and pattern analysis of Target #8 (Figure 16) indicate that there are only two isolated monopolar anomalies, neither of which represents a submerged cultural resource. For this reason and in consideration of the absence of corresponding acoustic data, no further study of this target area is recommended.

Target #9. Target #9 consists of three monopolar magnetic anomalies (M60, M54, and M58). M60 (56.5 gamma, 1 minute, 11.0 seconds) is a medium amplitude disturbance of long duration. M54 (7.5 gamma, 25.0 seconds) is considered a low amplitude disturbance of medium duration. M58 (75.5 gamma) is considered a medium amplitude disturbance of very short (<1.0 seconds) duration. The relatively low amplitude and relatively short duration of these magnetic perturbations and their monopolar signatures are not indicative of submerged cultural resources. Target #9 has no correlative acoustic data, nor does it lie within the construction impact area. Therefore, no further study of this target area is warranted or recommended.

Target #10. A pair (M53 and M49) of monopolar magnetic perturbations comprise Target #10. M53 (8.5 gamma, 29.0 seconds) and M49 (8.5 gamma, 26.0 seconds) are both low amplitude and of medium duration. The monopolar signatures, low amplitudes of M53 and M49, and the absence of correlative acoustic data are not typical of submerged cultural resources. Target #10 also lies outside of the construction impact area. Consequently, no further study of this target area is warranted or recommended.

Target #11. Target #11 is composed of three magnetic anomalies (M8, M5, and M2). M8 is a low amplitude (6.5 gamma), dipolar disturbance of long duration (1 minute, 10.0 seconds). M5 is a low amplitude (11.5 gamma), monopolar perturbation of long duration (36.0 seconds). M2 (36.0 seconds), also of long duration, is considered a low amplitude (12.5 gamma), monopolar magnetic disturbance. Although the increased water depth (approximately 40-50 ft) reduces amplitude measurements in the area of Target #11 by increasing the sensor-to-object distance, the absence of correlative acoustic data and the monopolar and dipolar signatures of anomalies M8, M5, and M2 together do not indicate that Target #11 represents a submerged cultural resource. Target #11 also is outside the proposed construction impact area. No further study of this target area is warranted or recommended.

Target #12. Target #12 consists of three magnetic disturbances (M12, M14, and M17). M12 (7.0 gamma, 25.0 seconds) and M17 (4.5 gamma, 24.0 seconds) are both monopolar disturbances of low amplitude and medium duration. M14 (7.0 gamma) is a low amplitude, dipolar disturbance of medium duration (26.0 seconds). As with Target #11, the deeper water in the area of Target #12 (approximately 40-50 ft) reduces the amplitude readings of its magnetic anomalies. However, the monopolar and dipolar magnetic signatures of M12, M14, and M17 are not characteristic of submerged cultural resources. Additionally, the location of Target #12 is outside of the proposed construction project impact area. For these reasons, no additional study of this target area is warranted or recommended.

Target #13. Target #13 is composed of a monopolar magnetic anomaly (M21) of medium duration (27.0 seconds) and low amplitude (5.5 gamma), and a dipolar disturbance (M16) also of low amplitude (6.5 gamma) but of long duration (41.0 seconds). As with Targets #11 and #12, the amplitudes of the magnetic anomalies comprising Target #13 are somewhat lessened due to deep water (30-40 ft). The monopolar and dipolar signatures of M21 and M16 are not characteristic of a submerged cultural resource. Based on these data, an absence of correlative acoustic data, and on

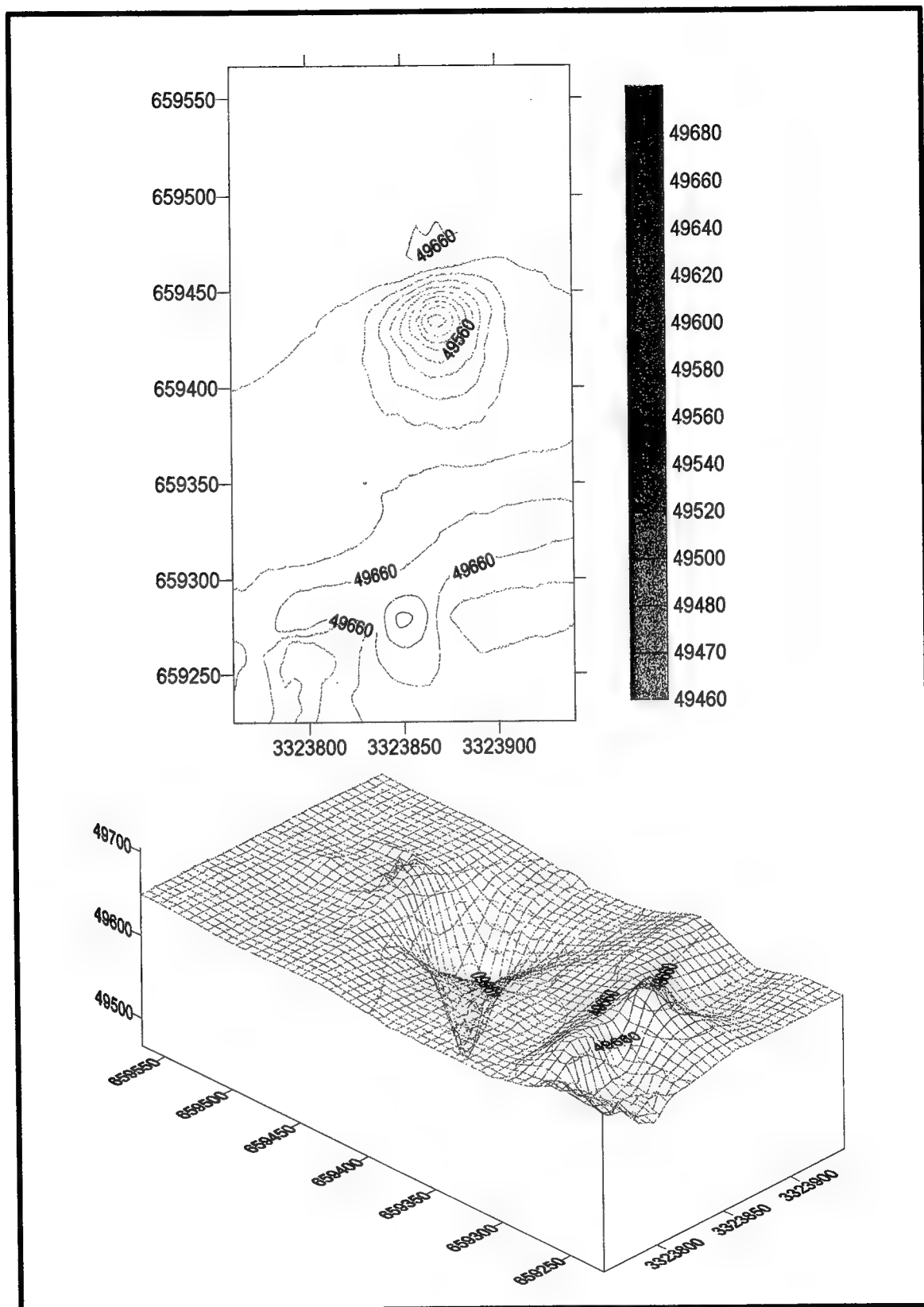


Figure 15. Magnetic contouring of Target #7

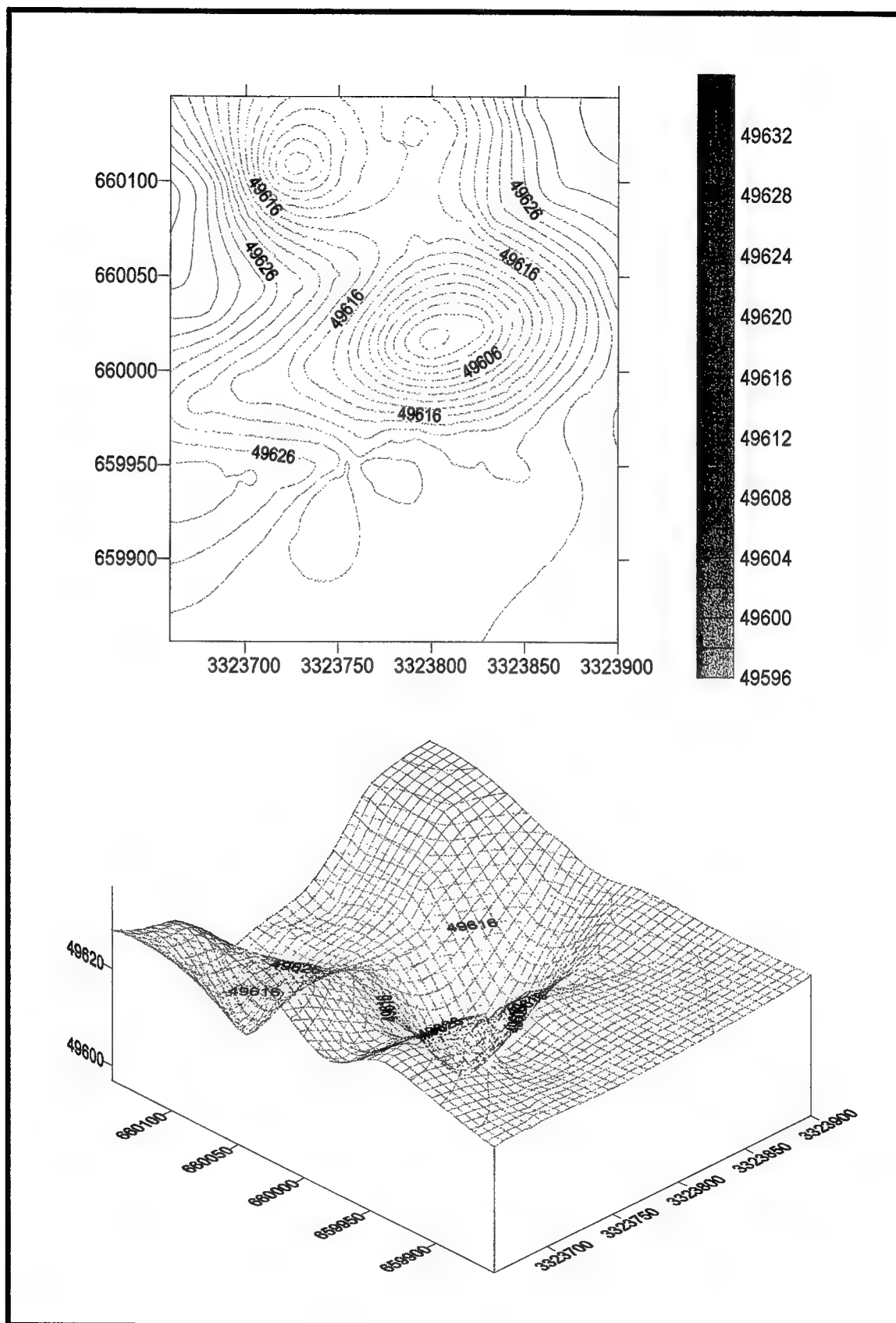


Figure 16. Magnetic contouring of Target #8

the fact that Target #13 is located a considerable distance from the construction impact area, no further study of this target area is warranted or recommended.

Target #14. A pair of monopolar magnetic perturbations comprises Target #14. M63 is a low amplitude (4.0 gamma) anomaly of long duration (1 minute, 4.0 seconds), while M64 is a low amplitude (6.0 gamma) anomaly of medium duration (28.0 seconds). In addition to the absence of correlative acoustic data, the low amplitude and monopolar magnetic signatures of M63 and M64 do not typify submerged cultural resources. Therefore, no further study of this target area is recommended.

Target #15. Target #15 is composed of a triad of monopolar magnetic disturbances: M69, M70, and M75. M69 (9.0 gamma) is a low amplitude, monopolar disturbance of long duration (2 minutes, 2.0 seconds). M70 (9.0 gamma) is a low amplitude, monopolar disturbance of long duration (54.0 seconds). M75 (4.5 gamma) is also a low amplitude, monopolar disturbance of long duration (52.0 seconds). The low amplitude and monopolar signatures of the magnetic anomalies comprising Target #15 are not characteristic of submerged cultural resources. In consideration of this fact and the absence of correlative acoustic data, no further study of this target area is warranted or recommended.

Target #16. Target #16 consists of a monopolar magnetic disturbance (M111) of long duration (33.0 seconds) and low amplitude (26.0 gamma), and a dipolar disturbance (M106) of medium duration (28.0 seconds) and medium amplitude (52.5 gamma). These low and medium amplitude, monopolar and dipolar signatures of magnetic anomalies M111 and M106 are not characteristic of a submerged cultural resource. Given the spatial proximity of Target #16 to the Manchac Revetment, it is likely that M111 and M106 represent ferrous debris associated with its construction. Based on these magnetic signatures and the absence of correlative acoustic data, no further study of this target area is recommended.

Target #17. Target #17 is a pair (M76 and M78) of magnetic anomalies. M76 (7.5 gamma) is a low amplitude, monopolar perturbation of medium duration (17.0 seconds), while M78 (13.5 gamma) is a low amplitude, dipolar perturbation of medium duration (22.0 seconds). The low amplitude, monopolar and dipolar signatures of magnetic anomalies M76 and M78 are not typically indicative of submerged cultural resources. Based on these data and on the absence of correlative acoustic returns, no further study of this target area is warranted or recommended.

CHAPTER IX

SUMMARY AND MANAGEMENT RECOMMENDATIONS

This report presents the results of a Phase I marine remote sensing survey for the Medora Crossing Soft Dike Construction Project on the Mississippi River, Iberville Parish, Louisiana. These investigations were conducted during November 1998, by R. Christopher Goodwin & Associates, Inc. on behalf of the U.S. Army Corps of Engineers, New Orleans District (USACE-NOD). The study was undertaken to assist the USACE-NOD in satisfying its responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended. Approximately 46.15 linear miles (74.27 km) of track lines were surveyed. The primary objective of this study was to locate any historic shipwrecks or other potentially significant cultural resources in the project area.

The marine remote sensing survey, utilizing side scan sonar and a recording proton precession magnetometer produced 24 acoustic and 117 magnetic anomalies. Analysis of these data found no correlation between acoustic and magnetic disturbances. However, data post processing established 17 magnetic target clusters. Of these targets, only Targets #1, #7, and #8 will be impacted by the proposed soft dike construction. The magnetic characteristics of the anomalies comprising Target #7 and Target #8 are not indicative of a shipwreck or other significant submerged cultural resource. The linear distribution pattern of these anomalies suggests that these targets are likely associated with ferrous debris slumped or washed into the survey area, such as segments of wire rope, of which several were visually detected on the adjacent riverbank (Figure 17). Based on these facts, the absence of correlative acoustic data, and on the lack of multi-component magnetic signatures, no further study of Target #7 and Target #8 is recommended.

The magnetic characteristics of the anomalies comprising Target #1 indicate a possible object or cluster of objects buried beneath several tens of feet of sediment. However, the magnetic contour study of Target #1 (Figure 15) indicates that this is a single anomaly representing isolated ferrous material. Based upon this information, this target does not appear to indicate a submerged cultural resource. Therefore, no further work on this target is recommended.

The remaining targets within the survey block will not be impacted by the soft dike construction project; no further work on these targets is warranted at this time. Based on these findings, it does not appear that the proposed soft dike project will effect any National Register eligible resources.

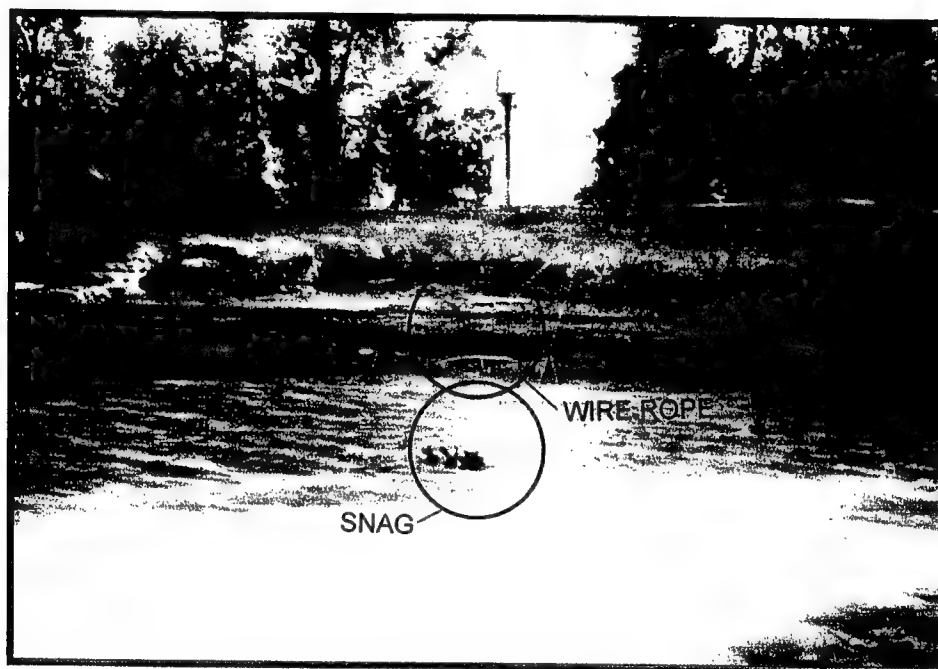


Figure 17. Photograph of wire rope emerging out of left descending riverbank and typical river snag

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Special thanks are also due to the staffs of the following repositories: The Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Archaeology, the Howard-Tilton Memorial Library at Tulane University, the Iberville Parish Courthouse, the Iberville Parish Public Library and the Hill Memorial Library at Louisiana State University. Particular thanks are extended to Mr. Steven Verry of NOAA for providing a prompt response to our request for information from the AWOIS, local historian Mr. Tony Fama and Historic Preservation Society Member Ms. Sue Hebert.

APPENDIX I

SCOPE OF WORK

14 Sept 1998

Revised
Scope of Services
Remote Sensing Survey of Medora Crossing Soft Diike Construction,
Iberville Parish, Louisiana

1. Introduction. This delivery order requires a remote sensing survey designed to locate submerged cultural resources, which may be impacted by the construction of soft dikes at Medora Crossing. The project features include the construction of a series of soft dikes to be built on the riverbed outside of the main channel. The dikes are designed for maintaining the river's navigation channel at a minimum 45 feet depth. The dikes will be constructed outside of and perpendicular to the main navigation channel to maintain alignment and achieve the required depth. Three dikes are proposed at Medora Crossing on the left descending bank, ranging in length from 600 to 1,650 linear feet. The dikes will tie into the bank. Each dike will be constructed perpendicular to the shoreline with approximately 600 linear feet of stone bank protection at the batture to prevent localized scour from flanking the dikes. This task order requires historic and geomorphologic background research, submerged remote sensing of the project reach, an inventory of the anomalies and recommendations concerning which anomalies may represent possible shipwrecks within the project area.

Adverse impacts to cultural resources can result from the construction of these dikes to any significant cultural resources in the project area. Adverse impacts include: 1) increase weight of sediments on any significant shipwreck, and 2) localized burial of possible shipwrecks changing their environment and possibly increasing the rate of decay.

2. Study Area. The study area consists of a reach of the river at Mile 212.0L as indicated on the attached map. The project area extends from the top of the bank to the edge of the navigation channel. See training dike locations shown on the attached map.

2. Background Information. The Mississippi River has been an important navigation route since prehistoric times. Prehistoric vessels were used in the river waters for transportation and commerce. In the colonial period, waterborne commerce was associated with French and Spanish trade and transportation routes. In the 19th Century more and more plantations were established along the river and its

distributaries. Boat landings existed up and down the River. Steamboats, barges and various ships plied the waters carrying sugar and cotton, other goods as well as passengers. At present, there are 42 recorded shipwrecks in the coastal waters of Louisiana and numerous wrecks in the rivers and bayous.

The number of recorded shipwrecks represents only a small fraction of the wrecks, which are expected to exist in the project vicinity. The project area has the potential to contain colonial era (ca. 1718-1803) shipwrecks as well as modern shipwrecks. The probability for shipwrecks in the project vicinity increase for nineteenth and twentieth century vessels due to the increased maritime commerce in the region.

A brief navigational history of the Mississippi River and an inventory of known shipwrecks in the study area is provided in the report entitled A History of Waterborne Commerce And Transportation Within the U.S. Army Corps of Engineers, New Orleans District and an Inventory of Known Underwater Cultural Resources prepared by Coastal Environments, Inc. This study documents two shipwrecks in the vicinity of the project area.

4. General Nature of the Work. The purpose of this study is to locate any historic shipwrecks in the above noted project areas. The study will consist of a systematic magnetometer and side scan sonar survey of the study areas using precise navigation control (GPS) and a fathometer to record bathymetric data. All potentially significant anomalies will be briefly investigated via additional intensive survey and probing of the water bottom (if possible). No diving will be performed under this delivery order.

The project requires historic background research, followed by the intensive survey of the proposed ODMDS area. An inventory of all magnetic, sonar, and bathymetric anomalies will be prepared. The background research, field survey, and data analyses will be documented in a brief management summary and comprehensive technical report.

5. Study Requirements. The study will be conducted utilizing current professional standards and guidelines, including, but not limited to:

the National Park Service's National Register Bulletin entitled "How to Apply the National Register Criteria for Evaluation";

the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation as published in the Federal Register on September 29, 1983;

Louisiana's Comprehensive Archeological Plan dated October 1, 1983;

the Advisory Council on Historic Preservation's regulation 36 CFR Part 800 entitled, "Protection of Historic Properties" and

the Louisiana Submerged Cultural Resources Management Plan published by the Louisiana Division of Archaeology in 1990.

The study will be conducted in three phases: review of background sources, remote sensing survey, and data analyses and report preparation.

Phase 1. Review of Background Sources. The CEI study referenced in Section 2. and the Louisiana Division of Archaeology Shipwreck database will be consulted. This phase is limited to a review of pertinent information contained in the referenced CEI report, and a review of available literature and pertinent historical, archival, and geomorphologic maps. The Chief of Engineers reports, and general histories of the parishes covering the project will also be examined.

In addition to reviewing the cultural background of the project area, geological and sedimentological studies will be examined to develop a concise summary of the physical environment of the project areas. This investigation specifically will examine issues relating to wreck dispersion and preservation as well as channel changes.

Phase 2a. Remote Sensing Survey. Upon completion of Phase 1, the contractor shall proceed with execution of the fieldwork. The equipment array required for this survey effort is:

- (1) a marine magnetometer;
- (2) a differential GPS positioning system;
- (3) a recording fathometer;
- (4) a side scan sonar system.

The following requirements apply to the survey:

- (1) transect lane spacing will be no more than 50 feet;
- (2) positioning control points will be obtained at least every 100 feet along transects;
- (3) background noise will not exceed +/- 3 gammas;
- (4) magnetic data will be recorded on 100-gamma scale;
- (5) the magnetometer sensor will be towed a minimum of 2.5 times the length of the boat or

projected in front of the survey vessel to avoid noise from the survey vessel;

(6) one run will be made along the transects with both the side scan sonar and the magnetometer,

(7) the survey will utilize the Louisiana Coordinate System.

Phase 2b. Definition of Anomalies. Additional, more tightly spaced transects will be conducted if necessary on potentially significant anomalies in order to provide more detail on site configuration and complexity. Probing of the water bottom will be performed at all potentially significant anomalies where water depths and weather conditions permit.

Two copies of a brief management summary will be submitted to the COR within 7 days after completion of the fieldwork. Additional requirements for the management summary are contained in Section 6 of the Scope of Services.

Phase 3: Data Analyses and Report Preparation. All data will be analyzed using currently acceptable scientific methodology. The post-survey data analyses and report presentation will include as a minimum:

- (1) post plots of survey transects, data points and bathymetry;
- (2) same as above with magnetic data included;
- (3) plan views of all potentially significant anomalies showing transects, data points, magnetic and depth contours;
- (4) correlation of magnetic, sonar and fathometer data, where appropriate; and
- (5) high quality reproduction of sonar records related to potentially significant anomalies.

The interpretation of identified magnetic anomalies will rely on expectations of the character (i.e. signature) of shipwreck magnetics derived from the available literature. Interpretation of anomalies will also consider probable post-depositional impacts, and the potential for natural and modern, i.e. insignificant sources of anomalies.

The report shall contain an inventory of all magnetic, sonar, and bathymetric anomalies recorded during the underwater survey, with recommendations for further identification and evaluation procedures when appropriate. These discussions must include justifications for the selection of specific targets for further evaluation. Equipment and methodology to be employed in evaluation studies must be discussed in detail. In addition the contractor shall classify each anomaly as either potentially eligible for inclusion in the National Register, or not eligible.

A product to be provided under this delivery order and submitted with the draft reports will include CAD graphics and/or design files compatible with the NOD Intergraph system. The maps and supporting files generated from marine survey data will show, at a minimum, the survey coverage area, the locations of all anomalies and other pertinent features such as: channel beacons and buoys, channel alignments, bridges, cables and pipeline crossings. Tables listing all magnetic anomalies recorded during the survey will accompany the maps. At a minimum, the tables will include the following information: Project Name; Survey Segment/Area; Magnetic Target Number; Gammas Intensity; Target Coordinates (Louisiana State Plane).

If determined necessary by the COR, the final report will not include detailed site location descriptions, state plane or UTM coordinates. The decision on whether to remove such data from the final report will be based upon the results of the survey. If removed from the final report, such data will be provided in a separate appendix. The analyses will be fully documented. Methodologies and assumptions employed will be explained and justified. Inferential statements and conclusions will be supported by statistics where possible. Additional requirements for the draft report are contained in Section 6 of this Scope of Services.

6. Reports.

Management Summary. Three copies of a brief management summary, which presents the results of the fieldwork, will be submitted to the COTR within 1 week of the completion of surveying the project area. The report will include a brief summary of the historical research and field survey methods by waterway, as well as descriptions of each anomaly located during the survey. Recommendations for further identification and evaluation procedures will be provided if appropriate. A preliminary map will be included showing the locations of each anomaly. A summary table listing all anomalies will be included with the maps. The table will include the following information: Project Name; Survey Segment/Area; Magnetic target number; Gamma Intensity; Target Coordinates (Louisiana State Plane).

Draft and Final Reports (Phase 1-3). Four copies of the draft report integrating all phases of this investigation will be submitted to the COR for review and comment within 16 weeks after work item award. The digitized project maps will also be submitted with the draft report.

The written report shall follow the format set forth in MIL-STD-847A with the following exceptions: (1) separate, soft, durable, wrap-around covers will be used instead of self covers; (2) page size shall be 8-1/2 x 11 inches with 1-inch margins; (3)

the reference format of American Antiquity will be used. Spelling shall be in accordance with the U.S. Government Printing Office Style Manual dated January 1973.

The COR will provide all review comments to the Contractor within 4 weeks after receipt of the draft reports (20 weeks after work item award). Upon receipt of the review comments on the draft report, the Contractor shall incorporate or resolve all comments and submit one preliminary copy of the final report to the COR within 3 weeks (23 weeks after work item award). Upon approval of the preliminary final report by the COR, the Contractor will submit one reproducible master copy, one copy on floppy diskette, and 40 copies of the final report to the COR within 26 weeks after work item award.

7. Weather Contingencies. The potential for weather-related delays during the survey necessitates provision of weather contingency days in the delivery order. One weather contingency day has been added to the fieldwork. The Contractor assumes the risk for any additional costs associated with weather delays in excess of one day. If the Contractor experiences unusual weather conditions, he will be allowed additional time on the delivery schedule but no cost adjustment.

APPENDIX II

RESUMES OF KEY

PROJECT PERSONNEL

**R. CHRISTOPHER GOODWIN, Ph.D.
PRESIDENT & CEO**

Dr. R. Christopher Goodwin, is President and Director of Research of R. Christopher Goodwin & Associates, Inc., a preservation planning and research and compliance firm with offices in Frederick, Maryland, New Orleans, Louisiana, Tallahassee, Florida, and Seattle, Washington. A native of Maryland, he is a former Yale Peabody Museum Research Associate (1976), Arizona State University Fellow, and Smithsonian Institution (1979-1980) Research Fellow and Scholar-in-Residence. Dr. Goodwin holds degrees in Anthropology/Archeology from Tulane (B.A.), Florida State (M.S.), and Arizona State (Ph.D) Universities; the latter institution named him a "College of Liberal Arts Leader," in 1997.

Dr. Goodwin is recognized as one of the nation's leading experts in cultural resource management. He has been a contractor to the U.S. Army Corps of Engineers (Baltimore, Memphis, Nashville, New Orleans, Pittsburgh, Savannah, St. Louis, and Vicksburg Districts), to the Naval Facilities Engineering Command, and to the Department of Defense on numerous projects. During the past 16 years, he has served as Principal Investigator for major cultural resource investigations conducted by his firm in the Mid-Atlantic, Southeastern, Western, and Caribbean Regions. These projects have included such large-scale efforts as the architectural and archeological investigations at Baltimore's Oriole Park at Camden Yards stadium site; the new Baltimore Ravens Stadium; and the Washington Redskins' Jack Kent Cooke Stadium.

Dr. Goodwin's expertise also has been called upon for historic preservation planning projects, and for industrial and governmental agency compliance with federal and state laws and regulations governing archeological and historic sites. He has served as Principal Investigator on preservation and compliance projects for the National Capital, Southeast, and Southwest regions of the National Park Service (NPS); the Department of Energy (DOE); Her Majesty's Service, U.K.; the Louisiana Division of Archaeology; major utility companies, including Allegheny Power, ENRON, Texaco, Southern Natural Gas (SONAT), ANR/Coastal, Baltimore Gas and Electric Company, and Peabody Coal; the U.S. Fish and Wildlife Service, Northeast Region; the City of Annapolis; and, the Maryland Historical Trust. The geographic range of research and compliance projects completed under Goodwin's direction encompasses the Leeward Islands, Puerto Rico, the Bay Islands of Honduras, Maryland, Virginia, West Virginia, Pennsylvania, Ohio, Illinois, Arkansas, Florida, Georgia, Louisiana, Mississippi, California, and Texas.

Dr. Goodwin has published widely in the fields of prehistoric and historic archeology, and ethnohistory. His areas of particular expertise include preservation planning, cultural resource management, cultural ecology, prehistoric demography, field methods in archeology, human osteology, and historic archeology. He is a court-qualified expert in both historic archeology and in cultural resource management. In 1992, he was a recipient of the National Trust for Historic Preservation's National Preservation Honor Award for his work at Maryland's oldest surviving historic building, the Third Haven Meeting House, and of the Anne Arundel County Trust for Historic Preservation's Achievement in Archeology Award in 1992 and 1993. In 1997, he received the United States Small Business Administration's Administrators Award of Excellence, for "Outstanding Contribution and Service to the Nation," and the Maryland Historical Trust's Educational Excellence Award.

In addition to numerous technical reports and monographs, Dr. Goodwin has contributed to numerous scholarly journals, including *American Anthropologist*, *American Antiquity*, the *Florida Anthropologist*, and *American Scientist*. Dr. Goodwin is listed in *Who's Who in Leading American Executives* and *Who's Who Among Outstanding Americans*.

JEAN B. PELLETIER, M.A.

NAUTICAL ARCHAEOLOGIST/SCIENTIFIC DIVER NAUTICAL ARCHAEOLOGIST/SCIENTIFIC DIVER

Jean B. Pelletier, M.A., graduated from the University of Maine in 1991 with a Bachelors degree in Geological Sciences, and received a Master of Arts degree in History from University of Maine in 1998. His research interests include maritime history and nautical archaeology, steamboat technology, industrial technology, remote sensing, geophysics, scientific diving technology, and underwater photography/videography. Mr. Pelletier has formal training in marine geophysics, remote sensing, remotely operated vehicles, and diving safety, and has conducted archaeological, archival, and geophysical investigations in Connecticut, Delaware, Louisiana, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Virginia. As a graduate student at the University of Maine, Mr. Pelletier worked with Dr. Warren C. Riess as a research assistant on the Penobscot Expedition Phase II, conducting remote sensing and underwater documentation of the ships of the Penobscot Expedition.

Before joining Goodwin and Associates Inc. in 1997 Mr. Pelletier served as an archaeological and scientific diving consultant for several universities and public utility companies along the Atlantic seashore. In this capacity, Mr. Pelletier managed the recovery of nine cannons from the *Nottingham Galley*, an eighteenth century English merchant ship lost on the ledges of Boon Island, Maine.

Since joining Goodwin & Associates Inc., Mr. Pelletier has been involved in numerous Phase I, II, and III archaeological investigations of underwater sites. He has conducted remote sensing surveys in the Gulf of Mexico, Chesapeake Bay, and a Phase III recordation of the steamboat *Kentucky*, a confederate troop-transport lost on the Red River in 1865, near Shreveport, Louisiana. Mr. Pelletier's professional affiliations include: American Academy of Underwater Sciences, Marine Archaeology and Historical Research Institute (MAHRI), and the Society for Historical Archaeology.

DAVID W. TRUBEY
NAUTICAL ARCHEOLOGIST

David W. Trubey graduated from the University of Massachusetts at Lowell in 1989 where he received a B.A. in History and the History Department's Outstanding Academic Achievement Award. Mr. Trubey will be receiving a Master of Arts degree in Historical Archaeology from the University of Massachusetts-Boston in 1998.

Before joining R. Christopher Goodwin and Associates, Mr. Trubey served as a field archaeologist and research assistant for the Massachusetts Board of Underwater Archaeological Resources from 1995-1998. Among numerous projects with the Board, David worked with the U.S. Naval Historical Center in compiling a comprehensive inventory of naval shipwrecks sites and resource management plan. During the field seasons of 1995-1997, he served as a Team Leader for the Institute for New Hampshire Studies-Plymouth State College excavation of an early eighteenth-century shipwreck at New Castle, NH. Mr. Trubey has also contributed historical and archaeological research for the cultural resource management of the Stellwagen Bank National Marine Sanctuary off the coast of Massachusetts. His research interests include remote sensing, maritime history and archaeology, and eighteenth and nineteenth-century canal construction.

Mr. Trubey is a PADI certified scuba diver and member of the Society for Historical Archaeology, Maritime Archaeology Research Institute, and the North American Society of Oceanic History.

WILLIAM B. BARR

ASSISTANT PROJECT ARCHEOLOGIST

William B. Barr received his Bachelor of Arts in Anthropology from the University of Alaska, Anchorage in 1990, and completed his Masters in Anthropology in 1995 from the University of South Carolina in Columbia. Specializing in both nautical and terrestrial archaeology involving multicomponent inter-tidal sites, Mr. Barr has worked on numerous Phase I to Phase III prehistoric and historic period projects in British Columbia, Canada, Alaska, Florida, Georgia, Illinois, Louisiana, North Carolina, South Carolina, and Tennessee. Mr. Barr has also conducted a number of public service projects ranging from public lectures on archaeology at elementary and middle schools, colleges, and retirement homes. While in South Carolina, Mr. Barr founded the Batesburg-Leesville Archaeology and History Project. Designed to ensure the preservation of sites containing archaeological and historical significance within western Lexington County, the BLAHP enjoys broad based community support from local leaders, businesses, and educators.

Prior to joining R. Christopher Goodwin and Associates, Inc., Mr. Barr served as a consultant on several projects for the South Carolina Institute of Archaeology and Anthropology, Underwater Division, in Columbia, South Carolina. Awarded Scientific Diver status in 1993 by the South Carolina Division of Archaeology, he also served as Project Archaeologist on the C.S.S. *Hunley* Project in Charleston, South Carolina in 1994. As well, Mr. Barr has participated in a number of surveys and excavations in the Ashley, Cooper, Pee Dee and Waccamaw Rivers, in addition to serving as an assistant instructor for underwater archaeology field classes. In 1995, Mr. Barr was employed as a Research Archaeologist by a cultural resources management firm in Columbia, South Carolina. In this capacity, he served as Project Manager on 12 U.S. Government Phase I military base contracts at Fort Bragg, North Carolina and Fort Stewart, Georgia for the National Park Service. In addition, Mr. Barr also served as Project Manager on a number of Phase I transmission line surveys, Civil War Period fortification surveys on James Island and Hilton Head, South Carolina, and Phase III plantation excavations in Beaufort and Charleston, South Carolina. In this capacity, Mr. Barr supervised the work of up to 12 archaeologists, along with his duties as client coordinator and the writing and production of approximately 25 cultural resource management reports.

Since joining R. Christopher Goodwin and Associates, Inc., in July of 1998, Mr. Barr has participated in several projects as an Assistant Project Manager and/or Marine Technician. These have included marine remote sensing surveys on the Mississippi and Calcasieu Rivers and along the Louisiana Gulf coast, in addition to Phase I terrestrial surveys for the U.S. Corps of Engineers, New Orleans District. Mr. Barr also has served as a remote sensing technician for a project in Illinois and as Assistant Project Manager for a Phase I survey at Oaklands Mansion in Murfreesboro, Tennessee for the U.S. Corps of Engineers, Nashville District. Mr. Barr's other duties have included the preparation of two Phase I cultural resources evaluation reports in addition to assisting with the preparation of other reports and management summaries.

Finally, and as part of his Master's degree thesis project, Mr. Barr established a preliminary typology for the construction of South Carolina Low Country Colonial Period ferry crossings/landings and their significance to Colonial Period settlement patterns within the state. Independently mapping one Colonial Period town and three crossings, located in the East and West Branch of the Cooper River and the Ashley River, the results of these studies were presented to the Society of Historical Archaeology in 1993, 1994 and 1995, and may be found within the Society's Underwater Proceedings publications for those years.

RALPH DRAUGHON, JR., Ph.D.

SENIOR HISTORIAN

Dr. Ralph Draughon, Jr., holds a Masters Degree and a Doctorate in southern history from the University of North Carolina at Chapel Hill, where he also earned a Masters Degree in Library Science with a specialty in rare books and manuscripts. He holds a certificate from the Rare Book School at Columbia University in New York City and has recently completed a short course in Environmental Site Assessment. Dr. Draughon taught American History at the University of Georgia for twelve years. He came to New Orleans from Stratford Hall Plantation in Virginia, where he organized and directed a research center, the Jessie Ball duPont Memorial Library. At Stratford, he served as historian of the plantation, a complex of eighteenth century buildings and the birthplace of Gen. Robert E. Lee. Dr. Draughon also has taught at Auburn University in Alabama and in the Historic Preservation Program at Mary Washington College in Fredericksburg, Virginia. He served as associate director and lecturer of a summer seminar for teachers, the Monticello-Stratford Hall-University of Virginia graduate course in colonial and revolutionary America. This program, which Dr. Draughon helped to start, won a special award from the American Association of State and Local History. Dr. Draughon also has served as Curator of Manuscripts and Archivist at the Historic New Orleans Collection, a museum-research center in the Vieux Carre. He has published articles in state historical journals and anthologies. For the past several years, Dr. Draughon has been working on a biography of William Lowndes Yancey, the southern political leader.

Dr. Draughon has served as Senior Historian at R. Christopher Goodwin & Associates, Inc., since 1990. He has performed extensive research throughout the southeastern United States and has applied the findings to the historical significance of a project area. Dr. Draughon undertook historical research for cultural resources surveys conducted throughout the southeastern United States where he described the historical development of each project area and reported on the significant themes relevant to understanding the history of the region.

CHARLENE KECK, M.A.

Ms. Charlene A. Keck received her Bachelor of Arts in Anthropology from the State University of New York at Oswego in 1990 and completed her Masters Degree in 1997 at the University of Georgia. Ms. Keck's research interests focus on faunal analysis and subsistence and how these fundamental issues relate to social organization and culture change. As an undergraduate, Ms. Keck was recognized by the Honors Department for her interdisciplinary research in literature and anthropology. While pursuing her graduate degree, she received the Southern Anthropological Society award for her research in Mississippian subsistence and nutrition.

Ms. Keck has extensive archaeological field and laboratory experience in eastern North America. Her field experience includes several Phase I surveys in northern New York, as well as Phase III mitigations on historical sites in Tennessee and New York City. She also worked on prehistoric Phase III mitigations in Georgia and Arkansas. Her laboratory experience includes prehistoric lithic analysis and collections management. Most recently, Ms. Keck served as project manager at the Zooarchaeology Laboratory, University of Georgia where she conducted research on the vertebrate remains from several sites in the Southeastern United States, the Caribbean, and Peru.

Since joining Goodwin & Associates, Inc., she has supervised the laboratory analysis of the Phase III mitigation at the Larose Site (16LF66). In addition, she has supervised several Phase I and II projects in the southeast, and has participated in the curation of artifacts for the Florida Gas Transmission Company and Southern Natural Gas Company projects.

WILLIAM HAYDEN, M.S.

ASSISTANT PROJECT MANAGER

Mr. William Hayden, M.S., Assistant Project Manager, received a Bachelor of Arts in Anthropology with an emphasis in Archeology from the University of California, Santa Barbara in 1989. After graduation, Mr. Hayden worked for a number of cultural resource management firms as a field technician in the Santa Barbara area of California before joining the Los Padres National Forest as an archeologist in 1990. While working for the Forest Service, Mr. Hayden was responsible for generating reports in addition to organizing and leading field crews in both Phase I and Phase II efforts along the central California coastal area. He also participated in the committee involved in the development of a standardized database for Region 7 forests. After leaving the Forest Service to pursue a Master's degree, Mr. Hayden worked as Crew Chief, Field Director, Database Manager, Information Systems Manager, Project Manager, and GIS/Data/Spatial Analysis consultant in the southern California area on numerous Phase I, II, and III projects. He also actively contributed to the development and implementation of a statewide GIS for the State Historic Preservation Office of California, as well as designing an independent GIS for the South Central Coastal Information Center at the University of California, Los Angeles. Recently, Mr. Hayden worked with members of the Pacific Coast Archaeological Society, California SHPO, and other interested parties in developing an MS Access-based standardized encoding system for archeological field and lab work. Mr. Hayden was awarded a Master of Arts in Anthropology with a concentration in Archeology from California State University - Fullerton in 1996. His thesis work focused on GIS-based regional settlement patterns in the prehistory of the San Joaquin Hills area in Orange County, California.

Since joining R. Christopher Goodwin & Associates, Inc. in 1998, Mr. Hayden has worked on the design and implementation of an MGE-based Cultural Resources GIS for the Army Corps of Engineers, New Orleans and Vicksburg districts, and he has conducted Phase I cultural resource surveys and archeological inventories, Phase II site evaluations, and EDM-based project mapping. He also has developed skills in the collection and interpretation of magnetometer data and performing intrasite spatial and statistical analyses of prehistoric and historic data recovery projects using the Surfer, Idrisi, and S-Plus software packages.

- * Participated in numerous Phase I cultural resource surveys and inventories throughout Louisiana and the southeastern United States.
- * Assisted in the development of a standardized database for Region 7 forests, worked on EDM-based project mapping and MGE-based Cultural Resources GIS; this knowledge can be used to assist the National Park Service in maintaining the Fort Polk Preservation Plan database. Experience in mapping artifact distributions across sites using Surfer, Idrisi, and S-Plus software packages.
- * Has focused on GIS-based regional settlement patterns in the prehistory of an area, which can be adapted to the Fort Polk Reservation.
- * Directed field crews in both Phase I and Phase cultural resource surveys.

MARTHA R. WILLIAMS, M.A., M.ED.
HISTORIC SITE SPECIALIST

Martha R. Williams, M.A., M.Ed., Project Manager, holds a B.A. (1960) from Lebanon Valley College; a Master of Education, with emphasis in the Social Sciences, from the University of Pennsylvania (1965); and an M.A. in History, with emphasis in Applied History, from George Mason University (1987). She was a Coe Fellow in American Studies at SUNY Stony Brook in 1982 and 1989. While completing her internship with George Mason University, she co-authored the Heritage Resource Management Plan for Fairfax County, Virginia.

Ms. Williams has had extensive experience in cultural resource management and in historical archeology in Northern Virginia. As co-director of the Fairfax County Seminars in historical archeology for high school student (1973-1987), she directed or assisted in the investigation of fifteen archeological sites in Fairfax County, including investigations at Belvoir Manor (1973-1975). Her experience includes volunteer work on both prehistoric and historic sites with the Fairfax County Heritage Resources Branch, for the City of Alexandria, for the Virginia Division of Historic Resources, and for the National Park Service, including excavations at the Lost Colony site on Roanoke Island. Ms. Williams' archeological experience also includes a field school with Colonial Williamsburg (1972), and employment with the National Park Service as an archeological laboratory technician.

Since joining R. Christopher Goodwin & Associates, Inc., Ms. Williams has served as historian, project archeologist, project manager, and public interpretation specialist for numerous studies conducted by the firm. She has co-authored reports and/or managed projects in Maryland, Virginia, the District of Columbia, Pennsylvania, Maine, Massachusetts, Vermont, North Carolina, Mississippi, Louisiana, and Puerto Rico. As public interpretation specialist, she designed and executed successful public information activities for the company's Stadium Project in Baltimore; the Drane House project in Garrett County, Maryland; the Icehouse Square project in Gettysburg, Pennsylvania; at the Gott's Court and Main Street sites in Annapolis, Maryland; at Pemberton Plantation in Salisbury, Maryland; and for two public information and training projects under the Legacy Program of the Department of Defense. She has managed such diverse projects as Phase I/II survey and evaluation of private developments in Anne Arundel County, Maryland, archeological testing of urban sites in Baltimore, archeological and architectural survey of the Redskins new stadium site in Prince George's County, Maryland, and preparation of the Cultural Resources Management Plan (CRMP) for the U.S. Naval Academy.

Ms. Williams also is actively involved with professional preservation organizations. She has served as Vice-President of the Archeological Society of Virginia, and currently sits on the ASV Board of Directors. She has written for numerous publications, including the *Yearbook* of the Historical Society of Fairfax County, *Museum News*, *Interpretation* (NPS), the *Quarterly Bulletin* of the Archeological Society of Virginia, *American Antiquity*, and the *Journal of Mid-Atlantic Archaeology*. In 1991, she received a Distinguished Service Award from the Fairfax County History Commission for her contributions to local history and preservation. She was recognized in 1992 by the Society for Historical Archaeology for her two-year service as Chair of that organization's Committee on Public Education. In 1996, the ASV recognized Ms. Williams as "Professional Archeologist of the Year."